RICE UNIVERSITY

Leader Emergence in Self-Managed Teams as Explained by Surface- and Deep-Level Leader Traits

by

Christina N. Lacerenza

A THESIS SUBMITTED
IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE

Doctor of Philosophy

APPROVED, THESIS COMMITTEE

Eduardo Salas, Ph.D.
Allyn R. & Gladys M. Cline Professor of Psychology
Chair, Department of Psychology

Margaret E. Beier, Ph. D.
Associate Professor of Psychology

Rick K. Wilson, Ph.D.
Professor of Political Science

HOUSTON, TEXAS
April 2017

ABSTRACT

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Leadership structures are flattening across organizations and teams, and according to Deloitte, the number one workforce trend of 2016 includes a shift from using traditional teams (whereby leadership and team member roles are clearly defined upon team inception) to self-managed teams (Kaplan et al., 2016). In comparison to traditional teams, self-managed teams do not have a designated leader upon team inception; instead, leaders come to fruition organically through a process deemed *leader emergence* (Humphrey, Hollenbeck, Meyer, & Ilgen, 2007). This process represents one that is bottom-up (i.e., leader(s) emerge from the team), rather than top-down, and is inherently ill-defined and flat. Accordingly, leadership is often dynamic and distributed on self-managed teams (Denis, Langley, & Sergi, 2012). Furthermore, this leadership structure is often referred to as shared leadership or leadership in the plural (Pearce & Conger, 2003; Denis et al., 2012). When effective, this type of leadership lends itself to increases among a host of desired team outcomes, including innovation, creativity, and performance (e.g., D'Innocenzo, Mathieu, & Kukenberger, 2016; DeSouza & Klein, 1995; Hoch, 2013).

Because the underpinnings of leadership within self-managed teams differs from that of traditional hierarchical leadership, it is necessary to conduct empirical research within this domain to fully understand its underlying processes. It is possible that inputs, processes, and outcomes that makeup traditional leadership structures do not operate in a similar manner for self-managed teams. Moreover, the heightened use of self-managed teams bolsters this need for

empirical research within this domain. Researchers have begun to scratch the surface regarding predictors of emergent leadership within self-managed teams (e.g., Ensari, Riggio, Christian, & Carslaw, 2011); however, a large portion of research conducted is cross-sectional using samples that might not generalize (e.g., teams working together for a few hours). Furthermore, researchers have recently called for more longitudinal research on self-managed teams (e.g., Kalish & Luria, 2016).

In response, the current study investigates the process of leader emergence within self-managed, engineering product-development teams over the course of 16 weeks. Drawing from implicit leadership theory (Lord & Hall, 2003; Shondrick & Lord, 2010), social role theory (Berdhal, 1996), diversity theory (Harrison, Price, & Bell, 1998; Harrison, Price, Gavin, & Florey, 2002) and relevant empirical research on leader emergence and individual differences (e.g., Barrick, Patton, & Haugland, 2000; Bergman et al., 2014; Deuling et al., 2011; Kalish & Luria, 2016), I argue that the criteria utilized to identify leader emergence changes throughout a team's lifecycle. In particular, during initial stages, surface-level leader traits predict leader emergence, but over time this effect diminishes and deep-level leader traits are leveraged. Results from two samples provide preliminary evidence of this notion. Assertiveness, a surface-level leader trait, predicted initial leader emergence; however, the variance explained was shared with grit-perseverance, a deep-level leader trait. In contrast, lagged leader emergence was only predicted by grit-perseverance. Supplemental analyses indicated that grit-perseverance predicted leader emergence and effectiveness above and beyond conscientiousness, indicating that the explanatory power of this deep-level leader trait may be more than originally anticipated.

DEDICATION

For Papa Vito and Grandma Lydia Lacerenza, and Uncle Richie Spano.

ACKNOWLEDGEMENTS

As I reflect back onto my graduate school career, I realize there is much truth to the adage that earning your doctorate is a marathon, not a sprint. Grit-perseverance is critical, small victories in route to the finish line should be celebrated, and you must keep your head up. Most importantly, you will also lean on others for guidance, faith, and encouragement. I'd like to acknowledge those who have been there for me throughout my time as a graduate student, and thank them for their continued support.

First, I would like to thank my advisor, mentor, and committee chair, Dr. Eduardo Salas. The advice and opportunities (to excel!) you have provided me with over the years have been invaluable. I'm forever grateful for all that you have done to help me pursue my career goals and aspirations. And, for encouraging me to continually go beyond what others believe is possible, think outside the box, and to create impact with my work. Your passion for organizational research and practice is one that I hope to emulate throughout my career, and I am so thankful to have you as an advisor.

I would also like to acknowledge my committee members, Dr. Margaret Beier and Dr. Rick Wilson. The feedback you have provided me with has contributed much to the final product, and I'm thankful for your insightful perspectives. I'd also like to thank Dr. Margaret Beier for the time spent during our meetings hashing out theoretical and empirical issues; your guidance has been invaluable.

I've also been fortunate to have several mentors outside of my committee who have provided me with insight, guidance, and advice critical for my professional growth and development. Dr. Dana Joseph, Dr. John Mathieu, Dr. Mikki Hebl, and Dr. Fred Oswald, I am forever grateful for all that you have taught me and for the time you have spent to help me

navigate through my career. Thank you. I am also very grateful for my collaborators at the Oshman Engineering Design Kitchen, Dr. Maria Oden, Dr. Matthew Wettergreen, and Dr. Ann Saterbak. Additionally, I'd like to thank the Doerr Institute for New Leaders for partially funding the current project through the Doerr Leader Development Innovation Awards Program.

I would also like to thank my fellow lab mates for their unyielding support, Shannon, Denise, Amanda, Julie, Chelsea, and Jensine; as well as Nivi and my Heblers, Christy and Rachel. To my former lab mates who continue to be an inspiration to me, Dr. Amanda Thayer and Dr. Jennifer Feitosa. And to Stephanie, we've sailed through the graduate school trenches together (sometimes operating at a standstill), and I'm so thankful for our friendship. I could not imagine surviving graduate school without all of you! To my best friends, Ellie and Lindy, thank you for your continued support over the years, for understanding when I'd cancel plans to work, and for encouraging me to take a break when I needed it most.

Lastly, I'd like to thank my family as I am very fortunate to have had your unconditional support throughout this journey. To my parents, Janice Lacerenza and James Lacerenza, thank you for instilling in me the value of hard work, dedication, and aspiration. Mom, you have inspired me to shoot for the moon and to remain optimistic despite setbacks. Dad, I cannot count how many times I've repeated to myself, "*When life gives you lemons, make lemonade*;" thank you for this advice. To my sister, Nicole Lacerenza, our bond is unsurpassable and your belief in me has been invaluable. Thank you for teaching me to be a warrior. And to John Jordan, my forever favorite and soon-to-be husband, thank you for your daily encouragements, motivation, and advice. You help me to see and understand things in a different light, and always know what to say to ensure that I don't lose sight of the big picture. Grazie, merci, gracias, obrigado, danke sehr, to all.

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CHAPTER 1: Introduction

Importance and Problem Statement

Leadership is crucial to organizations, teams, and dyadic partnerships as it is critical for motivation, resource mobilization, innovation, adaptation, performance, and a host of other desired outcomes (Antonokis & House, 2014). Studies have linked leadership to individual- (e.g., role clarity, follower satisfaction, employee well-being), team- (e.g., team and business unit performance), and organizational-level outcomes (e.g., organizational commitment, turnover) (Bass, 1985; Bono & Judge, 2003; Burns, 1978; Gerstner & Day, 1997; Griffeth, Hom, & Gaertner, 2000; Howell & Avolio, 1993; Scott, Colquitt, Paddock, & Judge, 2010). For instance, at individual-level, Shoemaker (1999) found that sales managers' leadership behaviors were directly related to their subordinates' job satisfaction and role clarity. At the team-level, researchers have identified a link between leader behaviors and team effectiveness (e.g., Lee, Gillespie, Mann, & Wearing, 2010; Somech, 2006; Srivastava, Bartol, & Locke, 2006), and at the organizational-level, dissatisfaction with a manager has a large impact on voluntary turnover (Garland, 2016). In particular, a recent study conducted by Gallup on 7,200 adults found that over half left a position at some point during their career "to get away from their manager" (Snyder, 2015; Weber, 2015).

Regardless of the relationship between leadership behaviors and outcomes across levels, the leader is often associated with organizational occurrences despite there being a direct link. For example, when mentioning a large company name, the Chief Executive Officer often comes to mind (e.g., Berkshire Hathaway and Warren Buffett; Apple and Steve Jobs). Moreover, research shows that when a company is struggling the most immediate factor to consider is the current, or soon-to-be, leader (Khurana, 2002). In addition to the strong influence *designated*

leaders have on individuals, teams, and organizations, research also suggests there to be a relationship between non-designated, or *emergent leaders*, and outcomes (O'Connor & Jackson, 2010). In fact, some argue this genre of leaders may be more influential as they possess a greater capacity to become long-term leaders (Foti & Hauenstein, 2007; O'Connor & Jackson, 2010) and because their power and influence is chosen by other team members, rather than being forced upon by an individual outside the team (Schneider & Goktepe, 1983; Serban et al., 2015). In a similar vein, empirical research suggests that groups in which a leader emerges outperformed groups without an emergent leader (DeSouza & Klein, 1995).

Although the concept of emergent leadership has been discussed for over 80 years (Barling & Weatherhead, 2016), this non-traditional form of leadership has increasingly become popular due to the influx of self-managed teams within organizations. A self-managed team represents a small group of individuals who work interdependently and share responsibility for goal achievement (DeRue, Nahrgang, & Ashford, 2015; Hollenbeck et al. 2012). Within self-managed teams, leadership is not assigned to one individual upon team inception; rather, leaders may come to fruition organically, a process deemed *leader emergence (*also referred to as emergent leadership*)* (Humphrey, Hollenbeck, Meyer, & Ilgen, 2007). In comparison to traditional leadership structures, where a sole individual is formally appointed the leadership role, leader emergence results in *emergent leaders*. This process represents one that is bottom-up (i.e., leader(s) emerge from the team), rather than top-down, and is ill-defined or flat, by nature. As a result, leadership on self-managed teams is often dynamic and distributed across team members (Denis, Langley, & Sergi, 2012). Further, multiple leaders may emerge on a team synonymously; which is why this structure is often referred to as *shared leadership* or *leadership in the plural* (Denis et al., 2012; Pearce & Conger, 2003).

The implementation of self-managed teams marks a recent organizational trend as this structure allows companies to remain competitive, innovative, and adaptive despite industry changes (Druskat & Wheeler, 2003; Ilgen, Hollenbeck, Johnson & Jundt, 2005; Roberson & Williamson, 2012; Stewart & Manz, 1995). According to Deloitte, the number one workforce trend of 2016 was the shift from traditional teams (whereby leadership and team member roles are clearly defined upon team inception) to self-managed teams (Kaplan et al., 2016). In addition to this, non-traditional leadership structures that result in emergent leaders may lend themselves to increases in gender diversity among leaders. The lack of female minority leaders in organizations today is not a new phenomenon; the statistics remain stagnant and researchers continue to investigate ways to combat this issue (Johnson, Hekman, & Chan, 2016). For instance, within S&P 500 companies only 14.2% of executives are female (Egan, 2015). In the popular press, the onus is often placed on women, with an encouragement for more assertive behaviors and the complaint that female employee professionals are not 'leaning in' (Sandberg, 2013). Although this might partially contribute to the lack of female leaders, scientific evidence points to a different cause: gender stereotypes (Lueptow et al., 2001). Men may pose as a more attractive leadership candidate because they have traditionally exhibited leader-like qualities, such as agentic attributes (e.g., assertiveness, power; Eagly & Johannesen-Schmidt, 2001). Contrastingly, women are perceived to express more communal qualities (e.g., concern for others, relationship-oriented; Blake & Mouton, 1964) – those that are not typically identified with leadership. In turn, when hiring, selecting, and identifying leaders, female candidates do not readily come time mind because they are perceived to engage in behaviors inconsistent with traditional leadership traits. Similarly, when evaluating male and female leaders, the prescription for effectiveness seems to differ (Johnson, Murphy, Zewdie, & Reichard, 2008) as research by

Lyness and Heilman (2006) suggests that women are held to higher performance standards than men when being evaluated for a promotion. Because of this, the rate at which women are formally designated as leaders may be lower than that of men; however, their level of leader emergence might be more comparable to that of men because this leadership distinction is based on the team's perception, rather than a formal appointment by others. Further, because leadership is dependent upon the team's needs (Bergman et al., 2014), the capacity by which an individual displays behaviors and traits necessary for team effectiveness may drive leader emergence, rather than an individual's degree of alignment with traditional leader stereotypes. Although meta-analytic data suggests that men tend to display greater levels of leader emergence, this discrepancy changes over time (i.e., the longer a team's tenure, the less discrepancy between male and female leader emergence ratings) and as a function of the team's tasks (Eagly & Karau, 1991). In sum, because the goals and requirements of a self-managed team drives who emerges as a leader, the rate at which women adopt the leadership role may be greater because gender stereotypes are not imposed by someone formally appointing the team's leader.

In parallel to the popularity of non-traditional leadership structures in organizations, research on shared and emergent leadership has also increased following a call for more research by Pearce and Conger (2003). In regards to leader emergence, researchers have mainly been concerned with investigating individual difference characteristics and behaviors related to leader emergence (Eagly & Karau, 1991; Ensari, Riggio, Christian, & Carslaw, 2011; Judge, Bono, Ilies, & Gerhardt, 2002; Lanaj & Hollenbeck, 2015), and strategies for increasing an individual's level of leader emergence (Yost & Plunkett, 2009). Through this research, several insights have emerged such as the predictive power of personality traits, cognitive ability, attitudes, and motivation (e.g., Ensari, Riggio, Christian, & Carslaw, 2011; Foti & Hauenstein, 2007; Judge,

Bono, Ilies, & Gerhardt, 2002; Kolb, 1998; Reub, Erksine, & Foti, 2008). However, most of this research has been concerned with the predictive validity of high-level personality traits (i.e., openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism), and several researchers have called for empirical investigations on the predictive validity of facet-level personality traits (e.g., Taggar, Hackew, & Saha, 1999). Previous research suggests that facet-level personality traits might explain a greater portion of variance in leader emergence (i.e., 59%; Zaccaro et al., 1991) as compared to aligning higher-order personality factors (i.e., 31%; Taggar et al., 1999), indicating a need for more research in this area. Additionally, inconsistent results regarding high-level personality traits and leadership criteria could be explained by differences between facets. In other words, it is possible that certain facets within the same higher-order personality factor relate positively to leadership criteria, and others negatively.

Furthermore, an assumption underlying most of this research is that if one emerges as a leader, s/he will continuously operate as such. Although this may be the case in some instances, it is likely that the individual influencing team members and displaying high levels of leader emergence changes through the course of a team's life cycle. This process is similar to other team emergent states (e.g., team cognition, a process by which team-related knowledge is organized, retrieved, and distributed among team members, thereby enabling team member to effectively coordinate and obtain team goals and responsibilities; DeChurch & Mesmer-Magnus, 2010), which are dependent upon team interactions, behaviors, and processes. For example, early research on leader emergence by Okanes and Stinson (1974) identified that the predictive validity of Machiavellianism on leader emergence changes over time, such that after spending time working with one another the rate at which those scoring high on high Machiavellianism were identified as leaders decreased. Interestingly, despite this phenomenon being documented

in early leadership research, few studies have taken the dynamic nature of leader emergence into account and longitudinal research within this domain is lacking (Kalish & Luria, 2016). While working on the team, it is inevitable that individual team members will engage in various behaviors over the course of the team's lifecycle. Because leader emergence represents the degree to which an individual who is not in a designated authority position exerts influence over others within a team and is perceived by others as exhibiting leader like behaviors (Lord, De Vader, & Alliger, 1986; Schneier & Goktepe, 1983; Taggar, Hackett, & Saha, 1999), it is likely the case that perceptions will change as a direct result of team member behavior change. Moreover, I believe dynamic leader emergence is a critical, yet overlooked phenomenon in the leadership literature.

Study Purpose

An important factor that may be related to leader emergence concerns team members' individual composition of individual difference characteristics, personality in particular. Previous research has suggested that personality is a large predictor of an individual's level of leader emergence (Ensari et al., 2011; Judge et al., 2002); moreover, researchers have also shown that personality can influence an individual's behaviors and others' perceptions towards that individual (Bono & Judge, 2002), particularly in the leadership domain. According to implicit leadership theory, an individual's level of leader emergence is partially explained by the degree to which this individual's personality and behaviors mirror others prototype of a leader. In other words, team members hold prototypes or schemas reflecting how they believe a leader should behave and what characteristics they should embody; the rate at which another team member's actions and personality aligns with this prototype determines their level of leader emergence. Drawing from this theory and building upon previous research on dynamic leader emergence

(Bergman et al., 2014; Deuling et al., 2011; Kalish & Luria, 2016; Okanes & Stinson, 1974; Serban et al., 2015; Sorrentino & Field, 1986), the current study further investigates how team members' perceptions towards one another may change in relation to leader emergence as a result of individual difference characteristics. The overall purpose of this effort is to further the field's understanding of leader emergence so that we can better attest to the underlying mechanisms of leadership within self-managed teams. A model is developed outlining predictors of leader emergence over time within this context and is tested utilizing a longitudinal, quasi-experimental study design. Specifically, the predictive validity of individual difference characteristics (i.e., assertiveness, grit, technical competence) is tested over the course of sixteen weeks. Moreover, the current results will provide answers to the following research questions: *Does an individual's level of leader emergence change over time? Does a certain pattern of individual difference characteristics explain leader emergence?* In doing so, this study offers several noteworthy contributions to the existing literature.

First, this effort advances current theory regarding leader emergence by further developing and testing a theory of surface- and deep-level leader traits. Building from Kalish and Luria's (2016) study investigating dynamic leader emergence as explained by physical characteristics and cognitive ability, the current effort tests a similar notion whereby leader emergence during initial stages of team formation is best explained by surface-level leader traits (e.g., assertiveness) and lagged leader emergence is best predicted by deep-level leader traits (e.g., grit, technical competence). Second, this work provides revelatory insight regarding leader emergence as predicted by facet-level personality traits. Although multiple studies have investigated the relationship between personality and leader emergence (e.g., Judge et al., 2002), few have assessed personality at the facet-level, rather than the higher-order factor. According to

Taggar, Hackew, and Saha (1999), personality traits at the facet-level may be more beneficial to leadership scientists and practitioners as these constructs may hold greater predictive validity. The current effort sheds light on this phenomenon by testing whether a pattern of facet-level personality traits (i.e., assertiveness, grit, technical competence) predicts leader emergence over time within self-managed teams.

Relatedly, the current findings will also provide clarity regarding the relationship between conscientiousness and leader emergence. Although some have indicated that conscientiousness predicts leader emergence (e.g., Ensari, Riggio, Christian, & Carslaw, 2011), others report a negative relationship (Deuling, Denissen, van Zalk, Meeus, & van Aken, 2011). It is possible that certain facets of conscientiousness predict leader emergence (e.g., achievement striving), while others are negative indicators of this construct (e.g., perfectionism). By investigating the predictive validity of grit, a facet of conscientiousness, this study progresses our understanding of this personality trait and leader emergence.

The current effort also provides the first empirical study identifying the relationship between grit (i.e., perseverance and passion for long-term goals; Duckworth et al., 2007) and leader emergence. Although grit has been linked to multiple desired outcomes, including both academic (e.g., Arouty, 2015; Chang, 2014; Kelly, Matthews, & Bartone, 2014) and non-academic (e.g., spelling performance, Duckworth, Kirby, Tsukayama, Berstein, & Ericsson, 2011; retention, Eskreis-Winkler, Duckworth, Shulman, & Beal, 2014) performance, the relationship between this facet of conscientiousness and leader emergence is unknown. According to Credé and colleagues (2016), grit has lost its luster due to a lack of incremental validity above and beyond conscientiousness in predicting performance and success outcomes. Perhaps grit is a better suited variable for predicting leadership outcomes with its makeup of

determination, persistence, long-term thinking and goal setting. The current study tests this theory.

Lastly, the current results will also assist in identifying ways to increase leadership diversity by identifying a potential solution to for reducing gender leader disparity. As previously mentioned, the increased use of self-managed teams in organizations is partially due to the fact this team structure might lend itself to increases in diversity. Related to this, I argue that the theory of surface- and deep-level leader traits tested in the current study will provide practitioners with a tangible strategy for reducing the gender leadership gap. Although men exhibit higher levels of leader emergence as compared to women, this effect has been said to reduce as the number of interactions between individuals increases (Eagly & Karau, 1991). Drawing from the current theory, it is possible that women display more deep-level leader attributes (e.g., perseverance, dependability); because these characteristics are not easily identified (Barrick, Patton, & Haugland, 2000), women are not selected for leadership positions at the same rate as men, who in comparison display surface-level leadership attributes (e.g., assertiveness). By empirically validating this theory using a sample that is generalizable to teams in the field, the current results will provide insight on how to reduce the gender leadership gap.

CHAPTER TWO: Literature Review

Leadership Criteria: Emergence and Effectiveness

Although there are many ways to conceptualize, define, and measure leadership (Burns, 1978; Clark & Clark, 1996; Hersey & Blanchard, 1982; Hogan et al., 1994; Hollander, 1985), most researchers have agreed that it can be categorized into two broad constructs: leader emergence and leadership effectiveness (Judge et al., 2002; Lord et al., 1986). Leader emergence represents the degree to which others perceive an individual to be leader like (Hogan et al., 1994), while leadership effectiveness reflects a leader's performance (Stogdill, 1950). Research on predictors of leader emergence and effectiveness began with the Great Man Theory (Stogdill, 1974), which posited that dispositions are the main contributors to these criteria. Although this theory received some support, most of the findings were inconclusive leading researchers to acquire a more behavioral approach to leadership (Stogdill, 1948). Due to the lack of findings suggesting universal traits that predict leadership success, researchers began to shift their investigations to identifying behaviors that influence leadership effectiveness (Stogdill, 1950).

The initial behavioral leadership theory was developed by a team of researchers at Ohio State University (OSU), led by R. Stogdill, C. Shartle, and J. Hemphill, (Judge, Piccolo, & Ilies, 2004). With their research, they concluded that only two meaningful leadership effectiveness factors exist: consideration and initiating structure (Fleishman, 1953). Consideration reflects the extent to which a leader expresses concern and appreciation for their subordinates and consists of human relations or interpersonal aspects of leadership. Initiating structure signifies whether a leader is concerned with facilitating goal attainment and engages in behaviors such as planning,

scheduling, implementing formal policies and procedures, and identifying team roles (Fleishman, 1953).

Despite meta-analytic evidence suggesting that both consideration and initiating structure have a moderate relationship with leadership effectiveness (i.e., corrected meta-analytic correlation coefficient $(\hat{\rho})$ = .52 and .39, respectively; Judge, Piccolo, & Ilies, 2004), the behavior theory that dominates current leadership research is transformational leadership theory (Barling, Christie, & Hoption, 2011). In 1978, Burns developed the foundation of transformational theory by identifying its premise and distinction from other leadership theories. Following suit, Bass (1985) further conceptualized the framework by introducing transactional leadership behaviors to the model. Transformational leaders are visionary leaders that challenge the status quo, provide followers with a higher, long-term focus, and appeal to their intrinsic needs (Burns, 1978), and transactional leaders focus on the exchange relationship(s) between the followers and their leader, and take a leadership approach aligned with social exchange theory (Blau, 1964). Transactional leadership consists of three dimensions, contingent reward, management by exception – active, and management by exception – passive. Although some researchers may argue transformational leadership styles are more effective than transactional approaches, meta-analytic evidence suggests that both predict leadership effectiveness (Judge & Piccolo, 2004).

Although behavioral leadership theories have permeated the current literature, in 2002 Judge, Bono, Ilies, and Gerhardt revived the trait approach by providing meta-analytic evidence for the predictive validity of personality traits on leader emergence and effectiveness. As such, it can be concluded that leadership criteria are best explained by a number of factors including behaviors, traits, and situations (Hughes, Ginnett, & Curphy, 2015). However, it might be the

case that more variance in leader emergence is explained by traits, while behaviors and situations explain more variance in leadership effectiveness. For instance, Arvey and colleagues (2006) found that 30% of the variance in a leader emergence variable, *leadership role occupancy*, was attributed to heredity (Arvey, Rotundo, Johnson, Zhang, & McGue, 2006; Arvey, Zhang, Avolio, & Krueger, 2007). Moreover, most of the evidence for the behavioral approach on leadership criteria has involved leadership effectiveness (e.g., Judge et al., 2004), and not leader emergence. Although, this could potentially be explained by the larger body of research focused on effectiveness, as compared to emergence[1]. Although both constructs display a substantive amount of literature, more work has been conducted with a focus on leadership effectiveness and this could be a result of the more traditional forms of leadership being more apparent, thus far (Barling & Weatherhead, 2016). With the rise of non-traditional leadership structures, comes the need for more research investigating the underpinnings of emergent leadership – or leaders who emerge organically, rather than being formally appointed. Because of this noticeable trend, the current effort is primarily concerned with leader emergence and conceptualizes leadership as "dyadic, shared, relational, strategic, global, and a complex social dynamic" (Avolio, Walumbwa, & Weber, 2009, p. 423.

An Overview of Leader Emergence

At a high-level, two methods of defining leadership exist: (1) formally appointed roles and (2) the process by which "one or more members of a group composed initially of equal status peers (i.e., no appointed leaders) exhibits notably high levels of leadership behavior and

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[1] For example, when searching both terms, leader effectiveness and leader emergence, using Google Scholar (a database for scholarly work), leader effectiveness returns 15,300 relevant articles, while leader emergence only returns 2,750 (December, 2016). Although these searches both return a fairly large number of studies, it is clear that more work has been conducted on leader effectiveness.

thereby attains higher status in the eyes of fellow group members" (Berdhal, 1996; p. 22). In early research, scholars typically considered (and therefore studied) leadership with the assumption that it reflected an individual officially designated as a leader; however, as research has progressed, we now hold the presumption that leadership behaviors can be enacted by multiple others and individuals are influenced by their team members in addition, or in replacement of, a formally appointed leader (Bedeian & Hunt, 2006; DeRue & Ashford, 2010; Pearce et al., 2007). The latter process represents *leader emergence* and is the underlying process of ill-defined or non-traditional leadership structures, such as shared leadership (i.e., "an emergent team property that results from the distribution of leadership influence across multiple team members"; Carson, Tesluk, & Marrone, 2007; p. 1218), collective leadership (i.e., "a dynamic leadership process in which a defined leader, or set of leaders, selectively utilize skills and expertise within a network, effectively distributing elements of the leadership role as the situation or problem at hand requires"; Friedrich, Vessey, Scheulke, Ruark, & Mumford, 2009; p. 933), and distributed leadership (i.e., set of leadership functions is carried out by the group; Gibb, 1954) (Denis, Langley, & Sergi, 2012).

In response to the adoption of leader emergence as a sign of the leadership role, researchers have shifted towards the notion that leadership is a social phenomenon and fluid group structure that emerges and shifts over time through interactions (DeRue et al., 2015). In other words, leader emergence results in leadership being determined by perceptions, interactions, and team characteristics. By definition, leader emergence reflects "a social process through which, over time and social interactions, some individuals gain leadership roles as a result of their group's acceptance and recognition (Côté et al., 2010; Neubert & Taggar, 2004)." (Emery, 2012; p. 429). Further, leader emergence occurs as a result of influence patterns in

teams over time. As a result of this, leader emergence lends itself to being researched using methods that capture change (e.g., longitudinal study designs) in order to fully understand its underlying processes. For instance, longitudinal research is needed to track the development of leader emergence in newly formed (i.e., ad-hoc) and existing (i.e., in-tact) teams. Despite this, the majority of studies within this domain measure leader emergence at one time point, typically at the end of the study (Berdhal, 1996).

When investigating leader emergence, most studies utilize one of two operationalization approaches. One approach focuses on leader role occupancy; this construct reflects whether an individual has been formally appointed a leadership position (Barling & Weatherhead, 2016). Typically, in studies assessing leader role occupancy, a predictive validation study is conducted whereby a series of individual difference characteristics are collected at time 1, and leader role occupancy is assessed at a later point in time (e.g., Reichard, Riggio, Guerin, Oliver, Gottfriend, & Gottfried, 2011). Leader role occupancy measures range from being binary (i.e., an individual holds a leadership position or does not; De Neve et al., 2013), focused on the capacity of the leadership role (i.e., number of subordinates; Li, Arvey, & Song, 2011), or a measure of the level associate with the leadership role (e.g., president versus vice president; Zhang, Ilies, & Arvey, 2009). The second approach to assessing leader emergence includes asking team members to provide ratings of other team members following a task or group discussion (e.g., Campbell, Simpson, Stewart, & Manning, 2003). In particular, team members are asked to either identify (i.e., nominate; Emery, 2012; Lemoine et al., 2016; Luria & Berson, 2013) team leaders or rate all other team members on their degree of leadership following a team task or group discussion. Within this paradigm, studies are often experimental and conducted using a student sample (e.g., Kickul & Neuman, 2000). Further, team tasks typically span a single moment in time and leader

emergence is assessed at the end of the task or group discussion (these discussions are commonly referred to as the leaderless group discussion; Ensari et al., 2011).

In looking at research questions associated with each approach, studies utilizing both methods have been focused on a similar question: *Who emerges as a leader?* Furthermore, the existing research, which is a culmination of 80 years of research (Barling & Weatherhead, 2016), has shed light on the answer to this question. In regards to leader role occupancy, individuals with higher levels of cognitive ability, self-esteem, reduced exposure to poverty, and other related genetic factors tend to obtain leadership roles later in life (Arvey, Rotundo, Johnson, Zhang, & McGue, 2006; Arvey, Zhang, Avolio, & Krueger, 2007; Barling & Weatherhead, 2016; Li, Arvey, & Song, 2011; Reichard et al., 2011). Moreover, certain personality traits have also been shown to influence this outcome (Judge et al., 2002). Relatedly, within teams working on leaderless group discussions and tasks, more extraverted individuals that display greater levels of extraversion, (Campbell, Simpson, Stewart, & Manning, 2003; Cogliser et al., 2012; Colbert et al., 2012), emotional intelligence (Cote et al., 2010), self-efficacy (Serban et al., 2015) and self-monitoring abilities (Kent &, Moss, 1990) are either nominated to a greater extent as a leader, or rated higher on leader emergence measures. As such, previous research has progressed our understanding of the antecedents to leader emergence; however, more research is needed to fully comprehend the complete leader emergence process. For instance, most research is conducted at one time point, and does not account for potential changes in leader emergence. Anderson and Wanberg (1991) in their study of leader emergence, where leader emergence was measured at a single point in time, at the end of a series of team tasks, admitted that "the phenomenon of emergence leadership is probably a process that evolves and changes over the

course of more than one meeting, and such developmental effects were not accounted for in this study" (Anderson & Wanberg, 1991; p. 393).

A large portion of leader emergence research also consists of team tasks contrived in an experimental setting (i.e., leaderless group discussions, leaderless group tasks); although this research is necessary, additional empirical work building from these experimental studies is desired to enhance the generalizability of conclusions drawn (Neubert & Taggar, 2004). In the actual work environment, self-managed teams will work together over an extended period of time, working on various tasks, and engaging in multiple interactions (Taggar et al., 1999). As such, it is important for researchers to consider teams as dynamic entities – rather than static – and align study methods to appropriately test for this structure. This problem is not one that is limited to leader emergence research, rather there is a lack of longitudinal team studies across the general teams literature (Deuling, Denissen, Van Zalk, Meeus, & van Aken, 2011).

In line with the calls for longitudinal research on leader emergence (Berdhal, 1996; Neubert & Taggar, 2004; Taggar et al., 1999), researchers have attempted to study leader emergence over time (e.g., Chaturvedi, Zyphur, Arvey, Avolio, & Larsson, 2012; Daly, Egan, & O'Reilly, 2015; Foti & Hauenstein, 2007; Hensley & Cooper, 1987; Li, Arvey, & Song, 2011; Reichard, Riggio, Guerin, Oliver, Gottfried, & Gottfried, 2011; Roberts & Herman, 1986; Rosen, Billings, & Turney, 1976). These investigations are longitudinal in nature such that predictors are collected at an earlier time point and leader emergence is assessed once following a period of time. Further, they have contributed much to our understanding of who emerges as a leader at one point in time, but by only measuring leader emergence once, are unable to account for a potential change in leader emergence as a team progresses through their lifecycle. The following

section outlines current longitudinal research on leader emergence and discusses how the current study builds upon this research.

Longitudinal Research on Leader Emergence

Leader emergence (or emergent leadership) reflects the degree to which an individual demonstrates leadership behaviors and the level of influence s/he holds on a group (Wheelan & Johnston, 1996). As such, it is an important variable within self-managed teams because those who hold high leader emergence levels are likely the leader of the group, thereby helping (or hindering) group performance. Within self-managed teams, typically a leader will emerge over time based on the team's current goals, tasks, and/or needs (Bergman et al., 2014). In other words, the group leader most likely does not emerge immediately upon team inception, but will be perceived by others as the leader after several team interactions. As such, it seems more appropriate to study leader emergence (or emergent leadership) over time instead of with cross-sectional methods. Despite this, most research on this phenomenon is cross-sectional. In fact, less than 20 longitudinal empirical studies have been published in the top ten leadership journals[2] (i.e., *The Leadership Quarterly, Journal of Applied Psychology, Academy of Management Journal, Academy of Management Review, Organizational Science, Personnel Psychology, Organizational Behavior and Human Decision Processes, Administrative Science Quarterly, Journal of Management*, and *Organizational Science*; Dinh, Lord, Gardner, Meuser, Liden, & Hu, 2014), with the majority being predictive validation studies involving leadership role

[2] The list of the leading leadership research journals was based on the list identified by Dinh et al., 2014. Moreover, to identify longitudinal studies of leader emergence, I searched through articles published in the 10 journals, which were returned after using the following key terms: *leader emergence* OR *emergent leadership* AND *longitudinal*. Articles were deemed relevant if they included leader emergence (or emergent leadership) as an independent variable or dependent variable and the study was conducted over time.

occupancy (i.e., the extent to which individuals occupy formal leadership positions; Arvey, Zhang, Avolio, & Kreuger, 2007). In other words, there is a dearth of research on leader emergence within self-managed teams, leading to a lack of understanding regarding how this might change over time.

In regards to leadership role occupancy, research suggests this can be predicted by a number of individual difference characteristics, including intelligence, dominance, self-efficacy, self-monitoring, socio-economic status, height, and extraversion (Chaturvedi, Zyphur, Arvey, Avolio, & Larsson, 2012; Daly, Egan, & O'Reilly, 2015; Foti & Hauenstein, 2007; Hensley & Cooper, 1987; Li, Arvey, & Song, 2011; Rosen, Billings, & Turney, 1976; Reichard, Riggio, Guerin, Oliver, Gottfried, & Gottfried, 2011; Roberts & Herman, 1986). For instance, Foti and Hauenstein (2007) investigated predictors of leader emergence (as indicated by whether individuals emerged as a leader or were promoted to a leadership position) using variable and pattern approaches. Specifically, they identified individuals who had emerged as a leader and collected data on these leaders over the course of nine months. Their results suggested that leader emergence was related to a specific pattern of individual differences characteristics (i.e., high intelligence, high dominance, high general self-efficacy, and high self-monitoring). Several other researchers have concluded that high levels of intelligence predict leader emergence (e.g., Daly, Egan, & O'Reilly, 2015; Li, Arvey, & Song, 2011). Early research on industrial research and development employees found intelligence measures predicted whether an individual was selected for a management position (Rosen et al., 1976). More recently, Daly and colleagues (2015) – using data from 17,000 participants – found that childhood cognitive ability predicted leadership role occupancy across an individual's lifetime. In addition to intelligence, personality has also been shown to play a role in predicting an individual's leadership role occupancy.

Specifically, in a longitudinal study by Reichard and colleagues (2011), they found adolescent extraversion to be a predictor. The relationship between these variables and leader emergence could be explained by implicit leadership theory (Epitropaki & Martin, 2004). According to this theory, past experiences shape an individual's depiction of what traits and abilities are indicative of a leader; moreover, these ideas represent cognitive schemas that specify what traits followers or team members anticipate and expect a leader to hold (Epitropaki & Martin, 2004).

Although less longitudinal research exists on predictors of leader emergence within leaderless or self-managed groups, several common themes have also been identified. Specifically, research also suggests that certain individual difference characteristics predict whether an individual emerges as a leader within a team (e.g., Barry & Stewart, 1997; Lanaj & Hollenbeck, 2015), and these relationships are explained by behaviorally-based mediators (Walter, Cole, van der Vegt, Rubin, & Bommer, 2012; Wolff, Pescosolido, & Druskat, 2002). In a study conducted by Lanaj and Hollenbeck (2015), they studied self-managed teams over the course of seven months in order to investigate leadership over-emergence (i.e., when one's level of leader emergence is greater than their effectiveness), and how gender predicts this phenomenon. Their results suggested that men, in general, over-emerge as leader as compared to women. Lemoine, Aggarwal, and Steed (2016) also investigated the effect of gender and leader emergence and found that gender interacted with leader emergence within self-managed teams. Specifically, women were more likely to emerge as a leader when the group's level of extraversion was high and when the percentage of male group members was larger (Lemoine et al., 2016). Research suggests that personality also predicts leader emergence on self-managed teams. Specifically, Barry and Stewart (1997) found extraversion to predict the amount of a team member's influence over group outcomes in a longitudinal study of 61 student teams. Moreover,

emotional intelligence and emotional recognition are predictors of leader emergence; however, their relationship is indirect. For instance, emotional intelligence predicts leader emergence within self-managed teams and this relationship is explained by the occurrence of behaviors. Specifically, those team members who are emotionally intelligence engage in constructive task and team management behavior, which in turn predicts their leader emergence (Wolff, Pescosolido, & Druskat, 2002). Similarly, task behaviors were found to mediate the relationship between emotion recognition and leader emergence in a longitudinal study conducted by Walter and colleagues (2012) using student project teams. In addition to individual characteristics, research also suggests the relationship between a leader and a follower predicts the follower's leader emergence level. Specifically, in an employee sample, Zhang, Waldman, and Wang (2012) found leader-member exchange (LMX) quality to predict an individual's level of leader emergence within their work group.

Dynamic Leader Emergence Over Time

Inherently, the process of leader emergence evolves over time. Within self-managed teams, leaders emerge as a result of several processes including role taking, behavioral adoption, and peer perceptions (Balthazard et al., 2009). Because of this, leader emergence takes time and may undergo changes as team members interact with one another. According to Hollander's (1958) theory of idiosyncrasy, an individual will be perceived as a leader by other team members only if they accumulate idiosyncratic credits; these credits are accrued when others perceive the individual to engage in behaviors indicative of a leader. This theory further bolsters the notion that leader emergence is a dynamic process; therefore, it should be studied as such. Although researchers have empirically tested changes in leader emergence (Bergman et al., 2014; Deuling et al., 2011; Kalish & Luria, 2016; Okanes & Stinson, 1974; Sorrentino & Field, 1986), this body

of research is relatively scarce and questions still remain. The current effort builds upon this research, which is outlined in Table 1 and discussed below.

Table 1
Summary of Previous Dynamic Leader Emergence Literature

Study	Team and Task Characteristics	Predictor(s)	Leader Emergence Measure Description	Measurement Process
Bergman et al. (2014)	• Students • Experimental design • 4-5 team members • 14 weeks • Designed a hypothetical organization	Leadership behaviors	"Leader emergence was assessed by measuring team members' perceptions of an individual's overall leadership. Participants were asked to rate, on three items, the overall degree to which they perceived each team member as a leader using a 5-point scale. Example items included "I consider this person a team leader" and "Our group receives guidance and direction from this person"." (p. 115)	Leader emergence was assessed three times, at Week 4, Week 10, and Week 14.
Deuling et al. (2011)	• Students • Quasi-experimental design • 25 team members • 8 months • Class work	Cognitive ability, personality	"Group influence, the dependent variable of the current study, was measured with the following item: ''Some people have a large influence on decision-making and opinions in groups, whereas other people have little influences on these processes. Please indicate how much influence you and your group members had on your work group during the past week.'' A response scale between 1 (''no influence'') and 7 (''large influence'') was used." (p. 579)	Leader emergence was assessed twice, at Month 4 and Month 8.
Kalish and Luria (2016)	• High-school graduates (male) • Experimental design • 13-15 team members • 2 days • Boot camp	Cognitive ability, physical ability	"Leadership emergence was assessed at T1 and T2 according to participants' responses to the question: "Whom do you view as a leader in the group?" We did not specify what we meant by "leader" because we wanted to capture respondents' spontaneous theories of leadership (cf. Lord & Maher, 1991)." (p. 1487)	Leader emergence was assessed twice, at Day 1 and Day 2.

Study	Team and Task Characteristics	Predictor(s)	Leader Emergence Measure Description	Measurement Process
Okanes and Stinson (1974)	• Students • Quasi-experimental • 4-6 team members • 20 group contact hours spanning 10 weeks • Management simulation	Machiavellianism	"A sociometric questionnaire was completed by the members of each team. The question was stated as follows: "Rank the members of your team from 1 to 5 based on how much you feel they have contributed to team operations. Rank the person you feel has contributed the most as number 1, the person who contributed second most as number 2, and so on through number 5 for the person who has contributed least." (p. 257)	Leader emergence was assessed twice, at the end of 5 contact hours (Week 2) and after 20 contact hours (Week 10).
Sorrentino and Field (1986)	• Students (male) • Experimental • 4 team members • 10 group contact hours spanning 5 weeks • Group problem-solving activity	Achievement-related motives, affiliation-related motives	"Subjects were asked to rate themselves and the other members of the group on how competent, self-confident, and interested they were in the game, on how motivated they were to help the group reach its goal, on how much influence they had, on how much they contributed to attaining the group's goal of success in the game, and on task and socioemotional leadership ability...Last, after the overall rating, group members were asked to nominate their choice for leader of the group." (p. 1094)	Leadership perceptions were collected every week.

The earliest account of dynamic leader emergence is Okanes and Stinson's (1974) predictive validity study. The authors tested the predictive validity of Machiavellianism (i.e., a personality trait associated with manipulation and persuasion), and assessed whether changes in validity occurred after teams worked together for an extended period of time. Teams consisted of college seniors and were tasked to participate in a team-based business management simulation. Leader emergence was assessed using ranks (i.e., rank who contributed the most to team operations) and measured after the team interacted for five hours and then again at 20 hours. Results suggested that those scoring high on Machiavellianism displayed high levels of leader emergence in the beginning; however, over time this relationship declined. A similar study was conducted by Sorrentino and Field (1986); however, they assessed whether an individual's source of motivation (i.e., achievement- and affiliation-related) was related to leader emergence and if this relationship changes over time. Team consisted of students, who worked together for a period of five weeks on a survival task. The authors concluded that individuals who are both success-oriented and affiliation-oriented, displayed higher ratings on leader emergence, while those who are both failure-threatened and rejection-threatened, displayed the lowest ratings. Over time, these effects persisted.

Interestingly, empirical research highlighting changes in leader emergence experienced a lull following these initial studies. In more recent years, however, interest in the topic has grown. In 2011, Deuling, Denissen, van Zalk, Meeus, and van Aken tested whether certain individual difference characteristics (i.e., personality, cognitive ability) predict group influence (a component of leader emergence), and if this effect persists over time. Teams consisted of students, and team sizes were fairly large with 25 team members. Group influence was assessed using a single-item at multiple time points (at the middle and end of an eight-month period), and

predictor variables were measured upon team inception. Results suggested that group influence changes over time, with an emphasis on extraversion in the beginning stages and cognitive ability, openness to experience, neuroticism, and conscientiousness at later stages. Bergman and colleagues (2014) investigated whether individual behaviors predict leader emergence within project teams, and tested whether this effect changed throughout the duration of the team's life cycle. Participants consisted of student teams working on a semester-long group project. Individual behaviors (i.e., task- and social-oriented) and leader emergence (i.e., three-item measure assessing others' perceptions of an individual's level of leader emergence) were assessed at three distinct time points throughout the semester. Results indicated that initial leader emergence is influenced by social-oriented behaviors and later leader emergence is more strongly related to task-oriented behaviors. Most recently, Kalish and Luria (2016) investigated changes in leader emergence over the course of two days. Specifically, the authors conducted a field study using a military assessment boot camp and used longitudinal exponential random graph models to determine the effect of abilities on leader emergence and whether emergence changes over time (i.e., from Day 1 to Day 2). Results suggested that leader emergence changes between days and this can be partially explained by others' perceptions of the degree to which an individual exhibits leadership-relevant attributes (i.e., cognitive and physical ability) and whether the individual shares attribute similarities with the observer.

Based on the aforementioned studies, we are fairly confident in the assumption that leader emergence is dynamic; however, questions remain regarding why an individual's level of leader emergence changes. Deuling and colleagues' (2011) findings suggest that the predictive validity of certain personality traits, measured at the higher-order factor, on leader emergence changes as a team interacts. But, *does this effect remain if personality is measured at the facet-*

level? According to Judge and colleagues (Judge & Bono 2000, Judge et al. 2002), it is critical for leadership researchers to investigate the predictive validity of lower-order personality facets (e.g., assertiveness, dependability) in addition to their high-level personality traits constituents (e.g., extraversion and conscientiousness, respectively) because the strength of the relationship between leadership criteria and personality traits measured at the facet-level may be greater. For example, previous research provides evidence that the amount of variance in leader emergence explained by traits is greater when personality is measured at the facet-level (i.e., 59% of variance; Zaccaro et al., 1991) as compared to its aligning higher-order factor (i.e., 31% of variance; Taggar et al., 1999). This notion has also been supported by additional research (Marinova, Moon, & Kamdar, 2013), and scholars conclude that measuring personality at a lower-level may yield greater validity for leadership criteria and that this type of research is needed to move the literature forward (Taggar et al., 1999). In response, the current effort builds upon Deuling and colleagues' (2011) conclusions by testing whether facets of extraversion and conscientiousness display similar relationships with leader emergence.

In regards to the type of teams studied in previous research, Kalish and Luria (2016) investigated changes in leader emergence over the course of two days and Deuling and colleagues (2011) looked at changes in leader emergence within teams comprised of 25 team members. Although these team characteristics are generalizable to certain teams, the majority of self-managed teams in industry display a different makeup, thereby limiting the generalizability of these findings (Deuling et al., 2011; Wheelen, 2009). Teams in this context consist of fewer members and operate over a longer period of time; as such, future research is necessary to draw finite conclusions applicable to self-managed teams in organizations. The current effort will draw conclusions that are more generalizable as the sample consists of teams that better mirror a

work environment – product-development teams, ranging from 4-6 members, who work together over several months.

Kalish and Luria's (2016) findings provided initial support for a theory regarding leader attribute salience and leader emergence. In particular, they draw from expectation states theory, which posits that leader emergence is determined by the rate in which an individual exhibits leadership-relevant attributes, and argue that leader emergence is largely driven by noticeable attributes initially and more covert attributes over time. The authors test and support this notion by identifying that physical ability (i.e., an overt leadership attribute) predicts initial leader emergence, measured on Day 1, and cognitive ability (i.e., a covert leadership attribute) predicts later leader emergence, measured the following day.

The current study provides an expansion to Kalish and Luria's (2016) initial theory by extending the rationale to personality traits. As previously mentioned, a large body of research suggests that personality traits are indicative of an individual's degree of leader emergence (e.g., Zaccaro, 1991; Judge et al., 2002). Moreover, according to personality researchers, certain personality traits are easier to judge during initial interactions as compared to others (Barrick, Patton, & Haugland, 2000). Building upon this, I argue that overt and covert leadership attributes include facet-level personality traits (i.e., assertiveness and grit, respectively) in addition to those attributes tested by Kalish and Luria (2016). In particular, I develop and empirically-validate a model of dynamic leader emergence, which draws on leadership and team development theories in addition to theories surrounding individual differences to explain changes in leader emergence over time. The present results will shed light on the underlying processes of leader emergence and the following research questions will be addressed: *Does an individual's level of leader emergence change over time? Does a certain pattern of individual difference characteristics*

explain leader emergence? The proposed theory and aligning hypotheses are described in the following section.

CHAPTER THREE: Hypothesized Model

Leader Emergence Over Time within Self-Managed Teams: The Case of Individual Differences as Triggers

Individual differences play an important role in determining one's tendency to seek out a leadership role and their effectiveness within this position (Ensari, Riggio, Christian, & Carslaw, 2011; Ilies, Gerhardt & Le, 2004). In fact, due to their criticality, scholars have gone so far as to coin the term *leader traits* to denote individual differences that relate to leadership. Zaccaro (2007) defines leader traits as "personal characteristics, reflecting a range of individual differences that foster consistent leadership effectiveness across a variety of group and organizational situations" (Zaccaro, 2007; p. 7). Moreover, several theories explain the link between individual differences and leadership. The Great Man Theory, which suggests that individual characteristics are the sole factor that distinguishes leaders from non-leaders, provided the foundation for early leadership research.

A more recent leadership theory, implicit leadership theory suggests a similar process; individuals perceive others to be leader-like if they display behaviors and individual characteristics indicative of a leader (Epitropaki & Martin, 2004). Further, Zaccarro, Kemp, and Bader (2004) provide a model identifying how leader traits predict leader process (i.e., leader emergence, leadership effectiveness, leader advancement and promotion). Parallel to this, a large body of research exists linking various traits to leadership criteria, including leader emergence (i.e., the degree to which others perceive an individual to be leader like; Hogan, Curphy, & Hogan, 1994) and effectiveness (i.e., a leader's performance in influencing and guiding the activities of others towards goal achievement; Stogdill, 1950). For example, Zaccaro and colleagues (1991) concluded that 59% of the variance in leader emergence can be explained by

personality traits. Relatedly, in a meta-analytic investigation of personality and leadership, Judge, Bono, Ilies, and Gerhardt (2002) found that the five-factor model of personality (i.e., the higher-order model of personality containing openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism; McCrae & John, 1992) has a multiple-correlation of .48 with leadership.

Based on this, it has been widely adopted that a large (and continuously growing) empirical research base supports the notion that traits are antecedents to leadership; however, scholars have also outlined the influence of situational parameters on leadership traits and the necessity of considering patterns of individual differences when predicting leadership (Zaccaro, 2007). That is, it is not sufficient to consider certain traits in silo of: (a) the leadership context and (b) other traits, when attempting to predict leadership criteria. Despite this call, a large portion of studies in this domain are conducted utilizing a *traditional leadership lens* – meaning, leadership is considered in regards to individuals who are *formally* appointed a leadership position. Further, the context in which the relationships are studied may not generalize to current workforce trends. Within the work environment, leadership structures constantly change over time and are becoming flatter (Erez, LePine, & Elms, 2002).

Organizations are also adopting the use of self-managed teams at an all-time high rate (Kaplan, Dollar, Melian, Van Durme, & Wong, 2016), with several companies (e.g., Wonderworks Consulting, Springest, BoP Innovation Center) implementing a holocratic leadership structure, whereby there are no formal, hierarchical leaders (Bernstein et al., 2016). These non-hierarchical leadership structures are also referred to as shared leadership structures, which can be defined as *distributed and dynamic leadership across individuals* (Pearce & Sims, 2000). Specifically, a formal leader is not designated during team inception; instead, leaders

emerge over time based on team needs, responsibilities, and goals (Bergman, Small, Bergman, & Bowling, 2014). In other words, leaders emerge organically and may change.

Because this leadership structure departs from traditional, hierarchical leadership structures (where an individual is formally appointed a leadership position), research is needed on teams displaying non-traditional leadership structures (such as self-managed teams) to fully understand the underlying relationships and patterns of leadership within this context. In addition to the need for research on teams with a non-traditional leadership structure (i.e., self-managed teams), leadership scholars have also identified a lack of empirical studies implementing both a variable and pattern approach to leadership. According to Foti and Hauenstein (2007), studies that follow the variable approach focus on variables (e.g., individual differences) across individuals and how they relate to certain criteria (e.g., leadership), typically at a single point in time. The pattern approach, however, is concerned with investigating clusters of variables (i.e., patterns) over time. Foti and Hauenstein (2007) further conclude, "given that leadership is situated in a social and dynamic context, in order to more fully understand the leadership process, researchers need to complement the variable approach with a pattern approach" (p. 347). In response to this, the current effort couples a pattern and variable approach in order to investigate the relationships between a set of individual difference characteristics on leader emergence within self-managed teams. As such, this study provides a robust study of leader emergence within a particularly under researched context. In particular, a set of hypotheses reflecting *whether* and *why* leader emergence changes over time within self-managed teams is developed and tested; these relationships are discussed below.

Leader Emergence in Self-Managed Teams Over Time

Inherently, the process of leader emergence implies change and takes time to develop. This leadership criterion represents the degree to which others perceive an individual to exhibit leader like behaviors and traits (Hogan et al., 1994); consequently, perceptual and social processing is necessary for it to occur (or emerge). Within self-managed teams, individual team members use cues or schemas in order to generate perceptions towards one another in regards to leadership (Lord, 1985). For instance, if a particular team member engages in behaviors indicative of a leader, such as defining team expectations and providing others with task instructions (Morgeson, DeRue, & Karam, 2010), they cue other team members that they are acting as the leader; in response, the other team members will perceive this individual to be leader like and look to them as a team leader. As such, an individual's level of leader emergence is determined by others' acceptance and recognition and depends on a number of factors including the individual, team members, and the situation (Emery, Daniloski, & Hamby, 2011). Because context plays a role, the team's current situation partially explains leader emergence and leaders within self-managed teams are often chosen as a result of how well they align with present team needs (Bergman, Small, Bergman, & Bowling, 2014). In other words, those exhibiting qualities desired by the team are more likely to be regarded as a leader by other team members (Zaccaro et al., 1991).

Empirical findings from Bergman and colleagues (2014) suggest that team needs drive leader emergence, which is cued by behaviors. During the initial stages of team formation, when the team focuses on the development of interpersonal relationships and team building, the authors found that individuals engaging in more social behaviors (e.g., "friendly and approachable; looked out for the personal welfare of group members"; p. 115) were regarded as

the leader. In the later stage of the team's lifecycle, however, team members exhibiting a greater level of task-oriented behaviors (e.g., "scheduled work to be done; assigned group members to particular tasks"; p. 115), were regarded as such due to the team's need for "…a final burst of activity" (p. 114) to ensure team goals are met. Relatedly, according to Spisak, Homan, Grabo, and Van Vugt (2012), facial cues can also affect an individual's level of leader emergence as leaders whose cues align with the current problem are preferred. For instance, for more competitive tasks and settings, masculine-looking leaders are preferred.

The need for alignment between an emergent leader and the team's existing situation can be explained by the prominent theory of teamwork processes outlined by Marks, Mathieu and Zaccarro (2001). According to Marks and colleagues (2001), throughout a team's lifecycle, the team progresses through transition and action phases, both containing distinct tasks, goals, and priorities. During transition phases, the team primarily focuses on evaluating and/or planning tasks in order to identify a plan of action to obtain the team's objectives. Action phases reflect time periods when team members conduct activities directly related to goal attainment. Both phases require distinct processes; furthermore, these processes rely on different individual qualities and behaviors in order to be completed effectively. For example, mission analysis, which takes part during the transition phase, requires a leader who can clarify and articulate the team's direction and emphasize the importance of working collectively (Morgeson et al., 2010). In contrast, leaders who participate in problem-solving, develop and implement solutions, and values different perspectives are required for effective problem-solving, which occurs during the action phase (Morgeson et al., 2010).

Drawing from this, and building upon previous research on dynamic leader emergence (e.g., Bergman et al., 2014), I propose that an individual's level of leader emergence will change

throughout the course of a team's lifecycle as a result of movement between action and transition phases. Specifically, individuals that emerge as a leader during team inception (i.e., the transition phase) will be different than those that emerge later in the team's lifecycle (i.e., the action phase) because each phase requires different knowledge, skill, and ability levels. For example, during the transition phase a team would depend on a leader that is able to identify goals and delegate responsibilities. Conversely, during action phases, the team may depend more on individuals that are persistent, adaptable, and exert the ability to continue working despite setbacks. Parallel to this notion that individual difference characteristics interact with the team's current situation to predict an individual's level of leader emergence, Deuling et al (2011) found support for a similar theory. Specifically, they investigated whether individual differences (i.e., cognitive ability and personality) predict group influence, and if these relationships persisted over time. Results suggested that extraversion is essential to group influence initially, but cognitive ability and other personality traits (i.e., openness to experience, neuroticism, conscientiousness) are more important after time has passed. Relatedly, Kalish and Luria (2016) found similar findings in short-lived groups; physical ability was more important in predicting leader nominations initially (i.e., Day 1) and cognitive ability displayed greater influence over time (i.e., Day 2).

The current study extends this research by testing whether individual difference characteristics (as indicated at the facet-level of personality, whereas Deuling and colleagues (2011) investigated personality at the higher-order level of personality) play a role in determining an individual's level of leader emergence on a long-term, self-managed team and whether these effects persist over time. Further, based on existing research and theory, I hypothesize that:

Hypothesis 1: An individual's level of leader emergence changes over time, as indicated by other team members' ratings of their initial versus lagged leader emergence.

Leader Emergence as Related to Individual Differences

Over time, the popularity of investigating the explanatory power of traits on leadership outcomes (i.e., effectiveness and emergence) has fluctuated. Historically, researchers began the quest to explain leadership using trait-based theories (e.g., the Great Man Theory). After the initial development of these theories, there was an influx of studies investigating whether leaders and followers differentiated on various personality traits, physical attributes, intelligence, or values. Following this spike in empirical research, Stogdill (1948) aimed to summarize the findings from studies published between 1904 and 1947. Stogdill (1948) concluded that for most of the predictors, results were inconsistent with the exception of a clear trend indicating that intelligence and leadership were related. In 1959, Mann conducted an updated review, found similar results, and concluded that the relationship between personality traits and performance is of small magnitude and unpredictable. However, researchers eventually gravitated back towards the trait-based approach, and the most common understanding today is that both the behaviorally-based approach and the trait-based approach hold value in explaining leadership outcomes (Zaccaro, 2007).

The resurgence of the trait-based approach began in 2002 with several meta-analytic investigations conducted by Judge and colleagues (e.g., Bono & Judge, 2004; Judge, Bono, Ilies, & Gerhardt, 2002). Specifically, Judge et al. (2002) reported the meta-analytic, multiple correlation between the five-factor model of personality (i.e., openness to experience, conscientiousness, extraversion, agreeableness, neuroticism; McCrae & Costa, 1997; Norman, 1963; Tupes & Christal, 1961) and leadership to be .48, demonstrating support for the trait-based

leadership perspective. In addition to this, recent empirical investigations supporting the claim that traits hold merit in predicting leadership outcomes have also been conducted (cf Zaccaro, 2007). As such, there is value in the trait perspective of leadership research, especially in regards to explaining whether an individual emerges as a leader (as indicated by other's perspectives) or chooses to obtain a leadership position. The current study tests whether certain patterns of traits explain an individual's change in leader emergence over time.

Initial Leader Emergence

Assertiveness → Initial Leader Emergence

Assertiveness refers an individual's "tendency to actively defend, pursue, and speak out for his or her own interests" (Ames & Flynn, 2007; p. 307). Behaviors indicative of an assertive individual include vocalizing needs, acting defensively, showing annoyance, demanding things, disagreeing with other team members, and utilizing influencing tactics (Ames & Flynn, 2007). Research suggests that assertive, or dominant, individuals are more likely to emerge and be perceived by others as a leader because this trait aligns with stereotypical schemas of leadership (Hegstrom & Griffith, 1992; Rueb, Erskine, & Foti, 2008). This assertion has been supported through empirical and meta-analytic research. Research indicates that individuals engaging in specific behaviors reflecting assertiveness, such as amount of verbal utterances, are perceived to be leaders (Lord, 1977; Lord, Phillips, & Rush, 1980; Morris & Hackman, 1969; Sorrentino & Boutillier, 1975; Stein, 1975; Stein & Heller, 1979). Mullen, Salas, and Driskell (1989) also indicated in their meta-analytic investigation that team members displaying the greatest level of verbal participation during team interactions displayed the greatest likelihood as being chosen as the leader.

As was previously alluded, the tendency for assertive individuals to display greater levels of leader emergence can be explained by both leader categorization theory (also referred to as implicit leadership theory; Lord & Hall, 2003; Shondrick & Lord, 2010) and social role theory (Berdhal, 1996). Leader categorization theory posits that team members utilize personality traits and characteristics as an indication of how to categorize themselves and others, leading to differing perceptions of leader emergence. That is, individuals categorize themselves and others as leaders or non-leaders based on perceptions of whether they display personality traits indicative of a leader (e.g., dominance, assertiveness) (Emery et al., 2013). As an extension of this, social role theory argues that the role of a leader is associated with agentic qualities, while communal qualities are not associated with leadership roles; further, men are perceived to be more agentic and women more communal, leading to the perception that men are leaders and women are not (Eagly, Wood, & Diekman, 2000). In 1991, Eagly and Karau found support for this theory in their meta-analysis of over 70 studies. Specifically, they found that men are more likely to emerge as leader because they exhibit, and are associated with, more assertive and dominant behaviors. Researchers also argue that stereotype threat might also contribute to the discrepancy between female and male leader emergence levels. Davies, Spencer, and Steele (2005) found that women preferred low-status leadership positions and opted out of high-status leadership positions after being reminded of gender stereotypes; no differences in preference regarding role status were found between men and women when women were not reminded.

In further support of the relationship between assertiveness and leader emergence, a large body of research has indicated that extraversion, the higher-order personality factor that comprises assertiveness, displays a relatively strong relationship with leader emergence (Ensari, Riggio, Christian, & Carslaw, 2011; Lemoine, Aggarwal, & Steed, 2016). In fact, Judge, Bono,

Ilies, and Gerhardt (2002) found extraversion to be the "most consistent correlate of leadership across study settings and leadership criteria" (p. 765), and reported a meta-analytic correlation of .34 between this personality trait and leader emergence. Bono and Judge (2000), reported similar findings and found assertiveness to hold the largest predictive validity of transformational leadership behavior out of all the facets of extraversion. Extraverted individuals are perceived to be leader like because they are not silent or withdrawn, rather they are active, outgoing, and exude social confidence signaling to others that they can lead the team to goal achievement (Costa & McCrae, 1992; Taggar et al., 2009). Parallel to the aforementioned theory and research, I extend this rationale and argue that assertiveness, a facet of extraversion, predicts leader emergence within the context of self-managed teams. As such, I hypothesize that:

Hypothesis 2: An individual's level of assertiveness predicts their level of initial leader emergence, as rated by other team members.

Lagged Leader Emergence

According to Barrick, Patton, and Haugland (2000), certain personality traits are easier to assess (and consequently more accurately assessed) than others, and this holds true for short interactions. Specifically, they found that interviewers are effective at assessing some personality traits (e.g., extraversion), but not others (e.g., conscientiousness). The authors conclude that a potential explanation for this finding is that because time is limited during an interview period, the assessor's ability to accurately assess personality traits that are more covert (i.e., conscientiousness) is hindered. Moreover, the interviewer would be better able to accurately assess this trait if several interactions took place. Relatedly, Funder (1995) discusses a similar phenomenon when describing the realistic accuracy model of personality traits. He explains that several factors lead to an accurate personality judgment, including how relevant behavioral cues

are to a personality trait (i.e., relevance), the degree to which these cues are able to be observed (i.e., availability), the level of detection of these cues (i.e., detection), and how these cues are used (i.e., utilization). Moreover, the accuracy of said personality traits is moderated by whether the trait is visible, frequently observed, and level of relationship between the individuals. In other words, the precision by which individuals judge others' personality traits is influenced by trait visibility, quantity, and quality of interactions.

This notion that certain traits are covert whereas others are overt has also been discussed in the leader emergence domain. In a meta-analytic investigation of gender differences in leader emergence, Eagly and Karau (1991) found that women are less likely to emerge as leaders in comparison to men. Furthermore, results suggested that this relationship was moderated by the amount of interactions that took place, such that as the number of interactions increased, the tendency for men to emerge at a greater degree than women decreased. The authors discussed that a potential explanation for this is that increased interactions lead to the discovery of more information about an individual. In a similar vein, it could be the case that during the beginning of a team's lifecycle leader emergence is predicted by overt, or surface-level, leadership traits (i.e., assertiveness, extraversion) and over time, leader emergence is better explained by covert, or deep-level, leadership traits (i.e., grit, conscientiousness, technical competence). In a recent empirical investigation of leader emergence in short-lived teams attending boot camp, this argument was tested and supported (Kalish & Luria, 2016). Although the authors referred to physical ability as an overt leadership attribute and cognitive ability as covert, I extend this research by investigating whether personality traits demonstrate the same effect. In other words, *are certain personality traits surface-level leadership traits and others more deep-level?*

Similar patterns occur in regards to surface- and deep-level diversity traits (Harrison, Price, & Bell, 1998; Harrison, Price, Gavin, & Florey, 2002). Surface-level diversity traits refer to differences in "overt, biological characteristics," (Harrison et al., 1998; p. 97) that typically consist of physical features, such as race, age, and gender. In contrast, deep-level diversity variables reflect differences among attitudes, beliefs, and values; those traits that are not readily visible, but emerge over time (Bell, 2007). Over time, as team members interact with one another, the implications of surface-level differences become less salient, while the effects of deep-level differences become more apparent (Harrison et al., 1998; Harrison et al., 2002). Surface-level differences are initially used by team members as a proxy for information because they lack further knowledge regarding their team members, but deeper-level information is eventually acquired through repeated interactions. I expect similar patterns to emerge regarding leadership traits; specifically, that surface- and deep-level leadership traits will interact with one another over time to predict leader emergence. As such, I do not hypothesize that assertiveness (i.e., a surface-level leadership traits) predicts leader emergence over time. Instead, I argue that leader emergence at a later time period is better explain by deep-level leadership traits (i.e., grit and technical competence); these hypotheses are further discussed below.

Grit →Lagged Leader Emergence

Grit is a personality trait that has recently received much attention in both science (e.g., Credé, Tynan, & Harms, 2016) and the popular press (Bradberry, 2016). Specifically, some scholars suggest this trait to be highly indicative of performance (e.g., Duckworth, Peterson, Matthews, & Kelly, 2007), while others remain skeptical suggesting that the construct "…does not appear to be all that different to conscientiousness" (Credé et al., 2016; p. 13). According to Duckworth, Peterson, Matthews, and Kelly (2007) grit is defined as "perseverance and passion

for long-term goals" (p. 1087). Moreover, gritty individuals are perceived to be resilient, focused, and successful because they continue to persist with long-term goals – despite being faced with failure and challenges. Grit is comprised of two facets (i.e., perseverance of effort and consistency of interest), both of which have been linked to performance; however, a recent meta-analytic investigation concluded that perseverance displays greater predictive validity (Credé et al., 2016).

Despite the rather large body of existing research on grit and performance outcomes, researchers have yet to consider this construct in relation to leadership. Leveraging previous research on grit and performance, I argue that this personality trait holds predictive validity on leader emergence after accounting for conscientiousness. Problem solving, creating a vision (i.e., identifying team goals), and modeling the way are competencies indicative of a successful leader (Bass, 1985, 1998; Posner & Kouzes, 1988, 1993; Russell, 2001). Furthermore, according to transformational and charismatic leadership theory, leaders foster positive change within their organization or team and motivate followers to achieve their full potential (Bass, 1998). Because grittier individuals display an increased ability to overcome setbacks and remain focused following failures, they may be better equipped to enact such behaviors. Their perseverance and consistency may also serve to motivate others to do the same, and because gritty individuals enact resiliency, they should be able to guide others on how to cope with challenges (Peterson, Walumbwa, Byron, & Myrowitz, 2008). In support of this, many empirical investigations have provided evidence of a strong relationship between an individual's level of grit and retention (e.g., Duckworth et al., 2007; Eskreis-Winkler, Duckworth, Shulman, & Beal, 2014). Relatedly, and in relation to leader emergence, DeSouza and Klein (1995) found that an individual's level of commitment to the team's goal predicted subsequent levels of leader emergence. Moreover,

those that exercise duty (i.e., the act of being reliable, committed, and able to follow through) are often regarded as a leader because these individuals do not rely on others to remain motivated, persevere through challenges, and execute (Lord et al. 1984; Manz & Sims, 1980; Marinova et al., 2013; Moon 2001; Stewart et al. 1996).

According to Credé and colleagues (2016), grit is a facet of the higher-order personality trait conscientiousness. As such, it is likely that these constructs share similar outcomes and underpinnings. In regards to outcomes, several researchers have found a positive relationship between conscientiousness and leader emergence, and this pattern has persisted in both face-to-face and virtual teams (Cogliser et al., 2012; Taggar et al., 1999). Further, research suggests conscientiousness is related to host of leadership components, including goal setting and task-orientation (Aronoff & Wilson, 1985; Barrick & Mount, 1993; Costa & McCrae, 1992; Kirkpatrick & Locke, 1991), and findings from Kickul and Neuman (2000) suggest that the level of conscientiousness within an emergent leader is related to the team's level of performance in a simulation task. The research linking conscientiousness to leader emergence is not always positive, however. In Deuling and colleagues' (2011) study, they found conscientiousness to negatively predict an individual's level of influence on the group (as rated by other team members), albeit the negative relationship was small. In a similar vein, Serban and colleagues (2015) found conscientiousness to only predict leader emergence in one out of three samples, the teams being student teams who were part of a quasi-experimental study. Serban concluded that the null relationship in certain teams could be explained by the fact that the teams who did exhibit a positive relationship were those that worked together for an extended amount of time. They further argued that several interactions might need to occur in order for individuals to perceive others as conscientious (e.g., diligent, work-oriented).

Due to the mixed findings on conscientiousness and leader emergence, more research is needed to fully understand this relationship. As has been indicated by several researchers (Costa, 1996; Taggar et al., 1999; Zaccaro et al., 1991), leadership measurement might benefit most from personality traits assessed at the facet-level. It is possible that various facets of conscientiousness relate to leader emergence in distinct ways, leading to inconclusive findings when the construct is measured at the higher-order level. For instance, deliberation (i.e., "caution, planning, and thoughtfulness"; Costa, McCrae, & Dye, 1991; p. 890) is a facet of conscientiousness that could yield a non-positive relationship with leader emergence; individuals who are exceedingly deliberate may not engage in risk-taking or challenge the status quo – two qualities associated with leadership (Ertac & Gurdal, 20120; Kouzes & Posner, 2006). Grit, however, which exudes goal-setting and task completion, most likely demonstrates a positive relationship with leader emergence (DeRue et al., 2011; Emery et al., 2013).

As is the case with conscientiousness, an individual's level of grit may be hard to assess if only a short interaction occurs (e.g., an interview, a brief team meeting). Relatedly, the ability to detect this individual difference might improve over time, as is argued to be the case with conscientiousness (Barrick et al., 2000). In addition to existing within an interview setting, this has also been found to be true in the context of leaderless teams as the relationship between conscientiousness seems to unfold over time (Deuling et al., 2011; Serban et al., 2015). Based on this, I argue that as the number of interactions between team members increases, their ability to recognize each other's level of grittiness also increases. Furthermore, as the team's lifecycle progresses and the team moves from the transition phase to the action phase, the need to adopt a leader that is able to deal with and overcome performance disruptions will intensify. This causes team members to identify others as leaders based on their level of grit because these individuals

display a greater likelihood to persevere and work towards team goal attainment. It is for these reasons that I hypothesize the following:

Hypothesis 3: An individual's level of grit predicts their level of lagged leader emergence, as rated by other team members.

Technical Competence → Lagged Leader Emergence

According to Hollander (1978), competence is "the most important single factor in the leader's effectiveness" (p. 154). Technical competence refers to an individual's level of knowledge, skills, and abilities that are relevant to the job and/or position, and is a critical part of leadership effectiveness. For instance, it was once reported that 77% of corporate leadership training programs were focused on improving leader technical competence (Saari, Johnson, McLaughlin, & Zimmerle, 1988). Research suggests that technically competent leaders are more influential, better accepted, and are more assertive than less competent leaders (Julian & Hollander, 1966; Price & Garland, 1981). Moreover, several studies have shown that technical training is positively related to leader performance (cf Murphy, Blyth, & Fiedler, 1992).

In a similar vein, Day and Silverman (1989) argue that cognitive ability may be "the most important predictor of technical competence on the job" (p. 26). Cognitive ability reflects an individual's ability to acquire new information and adapt to novel environments and technical competence is a component of this trait (Hunter, 1986) In regards to leader emergence, empirical findings suggest that those demonstrating high level of cognitive ability are perceived by other team members as the leader to a greater extent than those with lower levels of this quality (Kalish & Luria, 2016). Longitudinal research investigating leader role occupancy has also demonstrated a strong link between an individual's level of intelligence and later leader emergence (Atwater, Dionne, Avolio, Camobreco, & Lau, 1999; Foti & Hauenstein, 2007), even

when cognitive ability was assessed during the leader's childhood (Daly, Egan, & O'Reilly, 2015).

Because research suggests that cognitive ability predicts leader emergence, it could be argued that technical competence does so as well. This link can be partially explained by cognitive resources theory (Fiedler, 1986; Fiedler & Garcia, 1987), which suggests that intelligent and technically competent leaders are more effective because they are more adept at handling stressful situations. In line with theory, Murphy, Blyth, and Fiedler (1992) empirically tested the relationship between technical competence and leadership influence on group processes and found that the relationship existed only if the leader provided evidence to other team members that they possessed a high level of technical competence. Similarly, Driskell, Olmstead, and Salas (1993) found that individuals displaying high levels of task cues influenced other group members to a greater degree as compared to those who demonstrated lower levels of task cues. The authors further explain that an individual's display of task cues present a direct indication of their level of technical competence (Driskell et al., 1993). Additionally, according to Hollander's idiosyncrasy credit theory (1958), leaders are more accepted by team members, and therefore display greater levels of leader emergence, if they hold high levels of technical competence and task-related abilities. Perceived technical competence and task-related ability occurs only after an individual demonstrates to other team members, either through cues or behaviors, that they possess these qualities. As such, the idiosyncrasy credit theory projects that technically competent team members will emerge as leaders, but this process will materialize over time. In culmination with the aforementioned theory and previous empirical research, I argue that technical competence is a deep-level leader trait. Further, I hypothesize the following:

Hypothesis 4: An individual's level of technical competence predicts their level of lagged leader emergence, as rated by other team members.

Patterns of Individual Difference Characteristics as Related to Leader Emergence: Interacting Effects

According to Lanaj and Hollenbeck (2015), leadership over-emergence is "when an individual's leadership emergence is actually higher than that individual's leadership effectiveness" (p. 1476). In other words, this phenomenon represents inappropriate leader emergence, whereby the wrong individual emerges as a leader within a self-managed, or leaderless group. Leadership over-emergence may occur if an individual displays a trait that explains more variance in leader emergence as compared to leadership effectiveness. For instance, Judge and colleagues (2002) found the meta-analytic correlation between extraversion and leader emergence to be greater than that of leadership effectiveness. As such, highly extraverted individuals may be more likely to emerge as a leader, but less effective in that position (demonstrating leadership over-emergence).

According to McCrae and Costa (1997), assertiveness is a facet of extraversion (the higher-order personality trait); consequently, assertiveness may also predict an individual's tendency to over-emerge as a leader. In support of this, Lanaj and Hollenbeck (2015) found that when all else equal, men are more likely to over-emerge as leaders and this is explained by gender role theory (Eagly, 1987). According to this theory, women are less likely to emerge as leaders as compared to men because they are not perceived as demonstrating characteristics stereotypical of a leader, including assertiveness and dominance. In sum, assertive individuals are more likely to demonstrate leadership over-emergence; therefore, there is a greater probability that these individuals will emerge as ineffective leaders.

As was previously discussed, leadership within self-managed teams is dynamic and distributed; therefore, leader emergence may change depending on the team's needs (Bergman et al., 2014). Within the context of self-managed teams, because leadership *can* change, I argue that leadership *will* change if the leader is ineffective. That is, because an ultimate goal of the team is to achieve high performance, the leader will shift based on their ability to positively influence this desired outcome.

This argument can be explained by expectation states theory (EST, Berger, Fisek, Norman, & Zelditch, 1977), which suggests that an individual's perceived leadership ability is influenced by their demonstration of skills and abilities perceived as salient for current tasks. Further, team members portraying traits relevant to the team's current goals will be regarded as exhibiting leadership and influence. Based on this, I propose that individuals with a pattern of individual difference characteristics that is not indicative of leadership effectiveness (and therefore team effectiveness), will ultimately not demonstrate high levels of leader emergence. Specifically, because assertive individuals are more prone to leader over-emergence (i.e., demonstrating a high likelihood of leader emergence, but a low likelihood of leader success; Lanaj & Hollenbeck, 2015), their leader emergence levels will decrease over time if they do not hold high levels of leadership traits indicative of leadership effectiveness (i.e., grit, technical competence). As such, I hypothesize the following:

> *Hypothesis 5:* Grit moderates the relationship between assertiveness and lagged leader emergence, such that individuals scoring high on assertiveness but low on grit will demonstrate low levels of lagged leader emergence.

Hypothesis 6: Technical competence moderates the relationship between assertiveness and lagged leader emergence, such that individuals scoring high on assertiveness but low on technical competence will demonstrate low levels of lagged leader emergence.

The Current Study

The current study aims to enhance our understanding surrounding the process of leader emergence within self-managed teams. Specifically, the goal of this effort is threefold: (1) identify whether an individual's level of leader emergence, as perceived by other team members, changes over the team's life cycle; (2) investigate the predictive validity of several facet-level personality traits on leader emergence, and (3) provide an explanation to changes in leader emergence by testing whether surface- and deep-level leader traits interact with one another to predict leader emergence. To achieve these aims, I extend previous research and build upon current theories of leader emergence. In particular, Kalish and Luria (2016) provide initial evidence of surface- and deep-level leader traits through their test of overt (i.e., physical ability) and covert (i.e., cognitive ability) attributes as predictors of leader emergence in short-lived groups. The current effort is a derivative of this such that I examine whether facet-level personality traits operate in a similar manner when predicting leader emergence in long-term, self-managed teams.

This study also leverages personality research and theory, which posits that certain personality traits are more observable than others. Specifically, this research suggests that initial individual perceptions might be formed through cues from these apparent personality traits, rather than less-apparent traits; however, over time the less-apparent traits cue perceptions (Barrick, Patton, & Haugland, 2000; Funder, 1995). Within the context of leader emergence, team members utilize perceptual cues to identify who is the team leader. As such, it is likely the

case that a similar process occurs whereby surface-level (i.e., more apparent) leader traits are leveraged initially and deep-level (i.e., less apparent) leader traits become more influential for perceptions over time.

To test this theory, a set of hypotheses were developed and tested; the full model outlining the relationships tested is depicted in Figure 1 and a summary of the hypotheses tested is listed in Table 2.

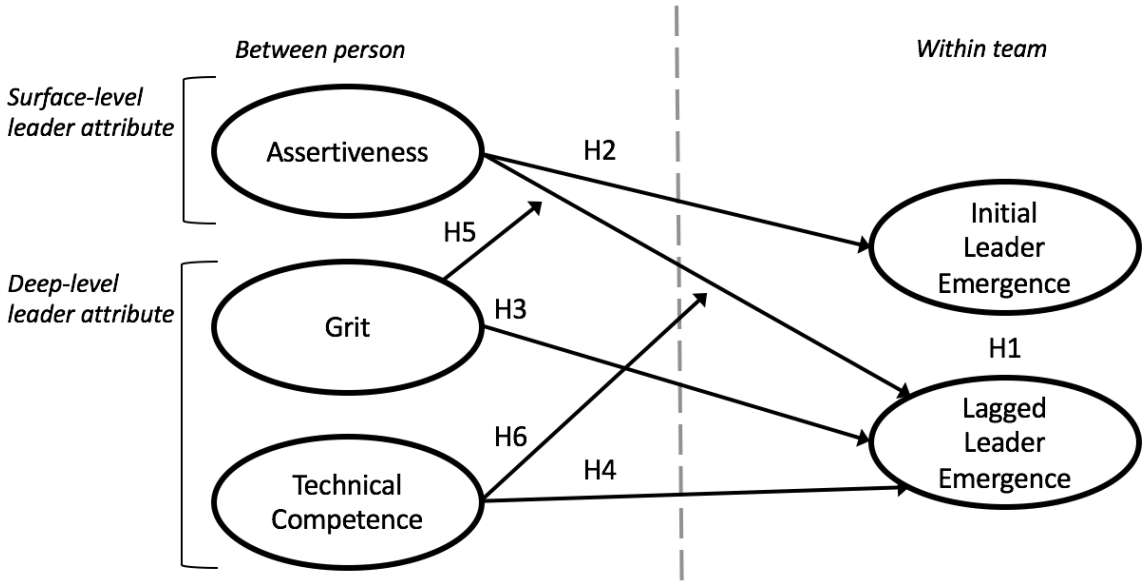

Figure 1. A Model of leader emergence in self-managed teams over time.

Table 2
Summary of Hypotheses Tested in the Current Study

Hypothesis	Description
H1	An individual's level of leader emergence changes over time, as indicated by other team members' ratings of their initial versus lagged leader emergence.
H2	An individual's level of assertiveness predicts their level of initial leader emergence, as rated by other team members.
H3	An individual's level of grit predicts their level of lagged leader emergence, as rated by other team members.
H4	An individual's level of technical competence predicts their level of lagged leader emergence, as rated by other team members.
H5	Grit moderates the relationship between assertiveness and lagged leader emergence, such that individuals scoring high on assertiveness but low on technical competence will demonstrate low levels of lagged leader emergence.
H6	Technical competence moderates the relationship between assertiveness and initial leader emergence, such that individuals scoring high on assertiveness but low on grit will demonstrate low levels of initial leader emergence.

In order to test these hypotheses, a pilot study and main study (with two samples) were conducted. The pilot study was conducted in order to provide initial evidence that certain facet-level leader traits (i.e., assertiveness, grit, and technical competence) have predictive validity of leader emergence. Following this, the main study was conducted to test the proposed hypotheses using two samples. Two samples were utilized in order to provide a robust test of the model; specifically, a sample of both ad-hoc (i.e., recently formed teams with team members who are not familiar with one another) and in-tact (i.e., teams with familiar team members who have or are currently working together towards a shared goal) teams were utilized to increase relevancy to the organizational context. According to Neubert and Taggar (2004), research on leadership in intact teams is needed because most research on individual differences and leader emergence has been conducted using "short-lived student teams" (p. 189), thereby limiting generalizability to

the work environment. As such, the current study attempts to address this concern and aims to provide a robust test of the proposed model.

CHAPTER FOUR: Pilot Study

Methods

Participants

Participants consisted of undergraduate students participating in a team-based engineering internship program at a small private research university. The engineering internship program is designed to provide students an opportunity to work collaboratively with other students (from various countries) to develop solutions to client-based projects. Thirteen students participated in the current effort and comprised four engineering design teams. All students were in an engineering discipline.

Teams were assigned at the beginning of the course; therefore, team members were not familiar with one another and had not worked together before the internship program. The majority of the participants were from the United States (54%) and the remaining were from Malawi (31%) and Brazil (15%). Fifty-four percent (54%) of the students were male, 46% female.

Setting

Recruited participants were part of a 7-week engineering internship program, designed to provide the students with hands-on exposure to engineering consulting work and product development. In the initial phase of the internship, participants were assigned to either a 3- or 4-person team; assignments were made by the course instructors. Following team inception, teams were provided with a project list and were to rank their corresponding interest level for each project. Then, teams were assigned a project, based on interest and availability. Throughout the duration of the internship, teams were responsible for the entire engineering process (i.e., from identifying and researching the problem to designing and implementing a solution).

Procedure

Teams were studied over the course of seven weeks, and their overall team goal was to develop a prototype of a product for a client. Clients were assigned to each product development team at the beginning of the internship, and they worked together for the duration of the program.

Data Collection

The current study is part of a larger effort; therefore, several data sources were collected throughout the duration of the internship. Self-reporting surveys were distributed at the beginning and the end of the internship. Daily reflections were recorded by each individual participant of the internship, including the teaching assistants. Weekly interviews were conducted with each team member by a trained member of the research team.

Self-Report Measure. For the purposes of this study, self-report measures were utilized to measure technical competence, while interview data was used to assess grit, assertiveness, and leader emergence.

Interviews. Interviews were conducted weekly by a trained doctoral student. Team members were interviewed separately, and the interview process did not interfere with project-based work. Each interview consisted of a set of questions regarding team processes, responsibilities, and practice, and feelings. Team members provided detailed answers on the tasks undertaken by the team for the current week. Sample interview questions include: *"Could you describe a typical day for me when you are working on projects in a team?"*; *"Could you describe the project you are working on now?"*; *"Could you describe the last time your team met?"*; *Can you describe how the team communicated?"*; *Did you feel comfortable expressing*

your ideas and opinions?" Finally, each team member was also asked explicitly to identify the leader(s) on their team.

The audio from the interviews was recorded and this audio was then transcribed by a team of trained undergraduate research assistants. Following transcription, leader emergence, assertiveness, and grit were coded. The Linguistic Inquiry and Word Count program (LIWC; Pennebaker, Francis, & Booth, 2001), a computer text analysis program, was utilized to code for assertiveness and grit. The LIWC program computes scores for multiple linguistic categories and provides a count for the percentage of words falling into each category. This program has been validated by comparing trained judges' ratings against program results (Pennebaker & Francis, 1996; Pennebaker & King, 1999). Further, the process for identifying leader emergence is discussed in the following section.

Measures

Assertiveness and grit. Similar to procedures conducted by Madera, Hebl, and Martin (2009), dictionaries for assertive and gritty words were developed from extant theory and research. First, the author developed an initial list of gritty and assertive words based on the literature. Then, the initial list was reviewed by four trained subject matter experts. Specifically, each rater identified whether each word reflected something a gritty or an assertive individual would say. The final dictionaries consisted of words marked indicative of grit and assertiveness by 75% of the trained raters. The assertive word dictionary consisted of 308 words; examples include: "*do this*", "*erase that*", "*focus on me*", "*honestly*", "*I insist*", "*leave it*", "*mine*", "*step up*." The grit word dictionary consisted of 302 words; examples include: "*bear it*", "*can't back* down", "*can't give up*", "*don't give up*", "*figure it out*", "*find a solution*", "f*inish*", "*give it a try*", "*keep going*." The full list of words included in both dictionaries is listed in Appendix A.

Technical competence. Technical competence was assessed using a self-report measure of proficiency in several skills related to the engineering design process, including: prototyping, drawing/sketching, laser cutter, sanding/painting/finishing, computer aided design, CNC machining, 3D printing, molding, mill/lathe, power tools, and electronics. Participants indicated whether they held either *none*, *some*, or *extensive* experience, and this measure was developed for the current study by subject matter experts (see Appendix B for full measure).

Leader emergence. Each team member was asked to identify the leader(s) on their team during each weekly interview. Team members that were identified as a leader at least once during the study were identified as exhibiting high leader emergence and were included in the analysis as a leader. Non-leaders comprised those individuals that were not identified by any team members as displaying leadership behaviors or holding the leadership position.

Analyses

Frequency counts were calculated to identify the amount of gritty and assertive words spoken by each group (i.e., leaders and non-leaders). Specifically, I calculated the following for each group: (1) the total average number of words spoken, (2) the average amount of gritty words spoken, (3) the average amount of assertive words spoken, and (4) level of proficiency in skills related to the team's goals, roles, and responsibilities (i.e., skills related to the engineering design process).

Results

Five participants (out of 13) emerged as leaders. Of those that emerged as leaders, results suggested that they spoke, on average, 222 more assertive words and 72 more gritty words during the weekly interviews. In total, in regards to technical competence, 60% of those that did emerge as a leader indicated that they held experience in 50% or more of the skills relevant to the

team's roles, responsibilities, and tasks. In contrast, only 33% of those that did not emerge as a leader did indicate the same.

Discussion

The purpose of the pilot study was to identify whether each predictor held merit in explaining an individual's likelihood of emerging as a leader. It is important to note that this study was not designed to account for change in leader emergence; rather, it was conducted to provide preliminary data on the predictive validity of assertiveness and grit. The current results suggested that during the interviews conducted over the course of seven weeks, 222 more assertive words were spoken team members who emerged as a leader as compared to those who did not emerge as a leader. Relatedly, 72 more gritty words were spoken by emergent leaders. Also in support of the hypothesized relationships, a greater percentage of individuals that emerged as a leader demonstrated high levels of technical competence. These results provide initial support for the relationship between these individual difference variables and an individual's tendency to emerge as a leader within a self-managed team.

Parallel to previous research on leader emergence (Hegstrom & Griffith, 1992; Rueb, Erskine, & Foti, 2008), I find that dominant, or agentic characteristics (e.g., assertiveness) are related to leader emergence. However, the current results suggest that additional traits may also be important when predicting leader emergence. As such, these results provide initial support for the notion that there is more than one path to leader emergence. According to implicit leadership theory (Epitropaki & Martin, 2004), team members will accept others as a leader depending on whether they enact behaviors indicative of their cognitive schema for a leader. Because of this, it could be the case that individuals exhibiting agentic qualities – those that are traditionally associated with leadership – emerge as leaders to a greater extent than those that demonstrate

different leadership behaviors (e.g., grit). The current results also lend initial support that although stereotypical leadership traits (i.e., assertiveness) are indicators of leader emergence, additional traits might hold merit as well (i.e., grit, technical competence). In sum, these results lend initial support for the identified hypotheses, but are regarded as preliminary and the main study will be conducted to make formal conclusions.

The main study will also test whether leader emergence changes over time as a result of individual difference characteristics. According to Kalish and Luria (2016), covert leadership attributes become more important in predicting leader emergence over time. Further, certain individual difference characteristics might be more important to leader emergence at different points during the team's lifecycle. For example, in the beginning of the team's life cycle team members engage in more transition processes (e.g., goal setting; Marks, Mathieu, Zaccaro, 2001) as compared to action processes (e.g., completing tasks). In response, individuals exhibiting behaviors necessary for effective leadership during transition processes (e.g., identifying the team's issue) may emerge as a leader during the beginning of a team's lifecycle as compared to the middle or end, when more action processes occur. The main study tests these hypotheses and extends Kalish and Luria's theory by testing a dynamic model of leader emergence in self-managed teams.

CHAPTER FIVE: Main Study Methods

Sample

The proposed model was tested using two samples, both of which are team-based engineering courses at Rice University. Two samples are utilized to ensure generalizability of the model across two different team types: ad-hoc and intact. Ad-hoc teams exhibit no history or future working together past the project duration, while intact teams have a history and future working together (Weaver, Dy, & Rosen, 2014). When investigating leader emergence, it is important to consider multiple team types as leadership perceptions might vary between teams with no history (i.e., ad-hoc) and those with a history of previous interactions (i.e., in-tact) (Anderson & Wanberg, 1991; Pavitt & Sackaroff, 1990). Both Sample 1 and Sample 2 demonstrate ecological validity, and are therefore generalizable to the work setting because they mirror typical product development teams. In particular, teams operate fairly autonomously amongst themselves and are provided a client that is experiencing an actual issue requiring a product to be developed. Teams are responsible for collaborating with one another and the client in order to identify and execute a solution that addresses the client's needs. Teams work with a variety of clients spanning multiple industries; example past and current clients include Shell (a leading oil and gas producer), Texas Heart Institute (a Texas non-profit corporation), and Texas Children's Hospital.

Sample 1

The first sample consisted of undergraduate students attending a semester-long engineering course at a private research university in the southern United States. This course is designed to provide students with an introduction to the engineering design process through project-based learning. Specifically, they work on a team with 4-5 members and are assigned a

client at the beginning of the semester. At the end of the course, teams are required to present a product prototype to their clients which attempts to solve the client's issue. Teams are fairly autonomous and work interdependently with one another in order to achieve the aforementioned aim.

A total of 13 participants, all first-year engineering students, consisting of 3 teams participated in the study. Within this sample, 84.6% (*N*=11) were male and 15.4% (*N*=2) were male. Participants' ages ranged from 18 to 21 ($M = 18.46$, $SD = .88$). Further, teams ranged from having 4 members to 5 members, with the average number of team members being 4.33. Participants were recruited at the beginning of the semester via classroom solicitation; participation was voluntary. In exchange for their participation, students were awarded with course extra credit and a gift card to Amazon.com.

This sample was surveyed over the course of three months (January 2017 – March 2017), with Time 1 data collected in January, Time 2 data collected in February, and Time 3 data collected in March. The total number of subjects recruited was 18, and the final sample consisted of 13 at Time 1, 13 at Time 2, and 13 at Time 3. Out of the 18 recruited, one person was unable to participate in the study because they were not 18 years of age or older. As such, their team was not utilized for the final sample as the analyses required participation from all team members. The response rate was fairly high at 72% (94% including those who participated, but did not have participation form all team members and therefore were excluded from the final sample) and in line with the recommended rate of 70% (Zhang et al., 2012). Moreover, the team participation rate was stable between Time 1 (72%), Time 2 (72%), and Time 3 (72%).

Sample 2

The second sample consisted of senior-level undergraduate students at a private research university in the southern United States. Students were attending a senior-level capstone course for engineering design, where they work on a team for two semesters and complete the entire engineering design process to develop a product for a client. At the beginning of the initial semester, team assignments are made and each team is also assigned a client. Over the course of two semesters, the team is responsible for working with the assigned client to identify their needs and develop, build, and analyze a product prototype that addresses their issue. In the beginning of the second semester, students were recruited via classroom and email solicitation and received a gift card and a free meal in exchange for their participation. Participation was voluntary.

A total of 48 participants were included in this samples, consisting of 9 teams (ranging from 4 to 6 members). There were 28 males (58.3%) and 20 females (41.7%), and the average age for this sample was 21.53 (*SD*=.55), with a range of 20 to 22. The average team size was 5.33. Beginning in January 2017, this sample was surveyed three times over the course of three months (January 2017 – March 2017). One survey was completed each month. The total subject pool consisted of 155 students; 90 students initially began the study. From these 90 participants, full data was obtained from 9 teams (*N*=48). At Time 1, 90 students participated, 90 at Time 2, and 90 at Time 3. As previously mentioned, however the final sample consisted of 48 participants as the remaining participants (*N*=42) were on teams that did not provide a complete team data set.

Procedure

Although the two samples differed in regards to certain characteristics (e.g., course level, team familiarity), the procedure for data collection was similar. For both samples, a longitudinal

study was conducted, and data were collected at three distinct time periods. First, participants completed an initial set of questionnaires which contained measures of personality (i.e., assertiveness, grit) and technical competence. This first wave of measures was collected at the beginning of the course for Sample 1 and at the beginning of the second course semester for Sample 2. After approximately three weeks of recurrent interaction among team members, participants rated each other on leadership criteria (i.e., of leader emergence, effectiveness, likeability) and overall degree of familiarity. The final wave of data was collected approximately three weeks following the second time point. The same measures completed at Time 2 were collected at Time 3. All surveys were completed through an online survey database (i.e., Qualtrics). Figure 2 outlines the data collection process.

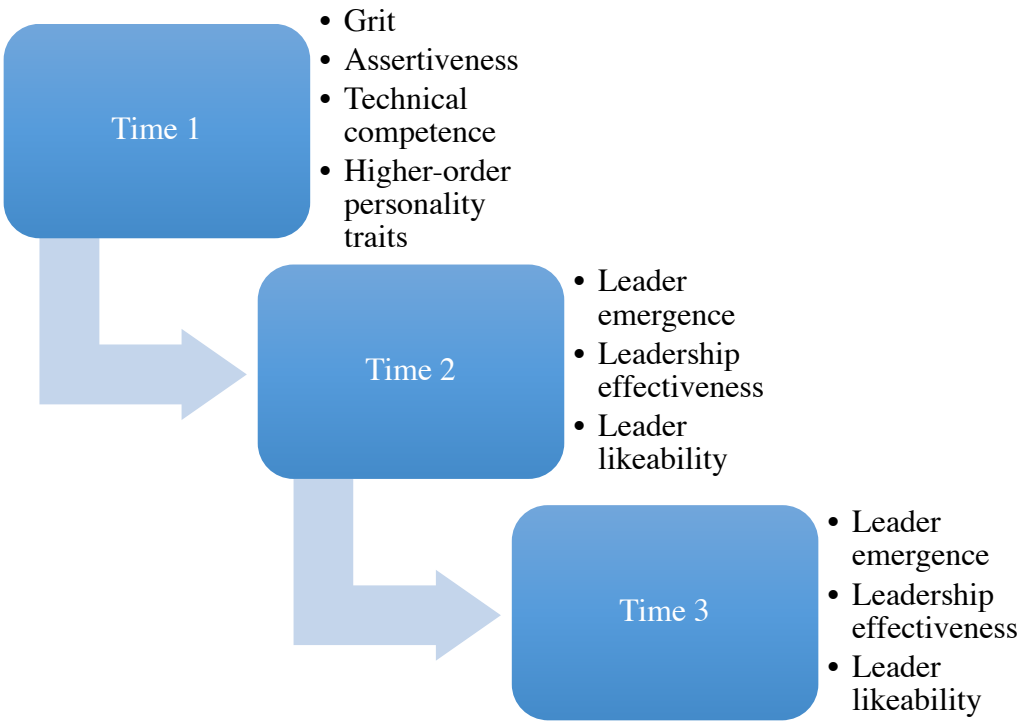

Figure 2. An overview of the data collection process.

Participants were repeatedly informed that their answers would remain confidential and informed that they could exit the study at any point without penalty.

Measures

Details regarding the assessment methodology is outlined below and in Tables 4 and 5. Moreover, the full measures are listed in Appendix A.

Demographics

Participants completed a set of demographic items consisting of age and gender.

Assertiveness

Assertiveness was measured using a short-form of the Rathus assertiveness schedule developed by McCormick (1985). This scale consists of 19 items and has been utilized in prior research (e.g., Shafiq, Naz, & Yousaf, 2015). Participants were asked to rate their level of agreement using a 5-point Likert scale ranging from 1 (*Not at all like me*) to 5 (*Very much like me*). Sample items include "*I am quick to say what I think*," "*There are times when I look for a good strong argument*," and "*Most people stand up for themselves more than I do*." Internal consistency (i.e., Cronbach's alpha) for this measure was $\alpha = 0.88$ (Sample 1) and $\alpha = 0.76$ (Sample 2).

Grit

To assess grit, the Grit-S scale developed by Duckworth and Quinn (2009) was utilized. This scale consists of two factors (i.e., consistency of interest and perseverance of effort) and 12 items (six per dimension). Participants were asked to rate their level of agreement using a 5-point Likert scale ranging from 1 (*Not at all like me*) to 5 (*Very much like me*). Sample items for consistency if interest include: "*I have difficulty maintaining my focus on projects that take more than a few months to complete*" and "*I often set a goal but later choose to pursue a different*

one." Sample items for perseverance of effort include: "*I finish whatever I begin*" and "*I have overcome setbacks to conquer an important challenge*." Internal consistency for grit-consistency was $\alpha = 0.34$ (Sample 1) and $\alpha = 0.77$ (Sample 2). Internal consistency for grit-perseverance was $\alpha = 0.65$ (Sample 1) and $\alpha = 0.81$ (Sample 2). It is important to note that recommendations by Credé et al (2016) were followed when assessing grit. Specifically, I considered this construct to be multifaceted, consisting of a perseverance and consistency factor, rather than being unidimensional.

Leader Emergence

Because leader emergence marked the primary dependent variable of concern for this current effort, careful consideration was undertaken in order to implement a reliable and valid measure of this construct. To do so, a systematic literature search was conducted to identify empirical studies, and their corresponding leader emergence measures, that have previously assessed leader emergence.

To identify relevant literature, two databases were searched (i.e., Business Source Premiere and PsycInfo) using several relevant key terms, including *leader emergence*, *emergent leadership*, and *leadership emergence*. This resulted in a total of 93 relevant studies. Following the extraction of relevant studies, the measure details for the leader emergence measurement method was reviewed. One of the most common methods for assessing leader emergence included using a nomination technique, which typically consists of a single-item measure whereby each team member is asked to identify the sole individual they rely on for leadership within the team. Further, a large portion of studies also used the General Leadership Impression questionnaire (Cronshaw & Lord, 1987) which consists of a five-item, Likert style response scale

and the three-item measure developed by Kent and Moss (1994), which also uses a Likert style response scale.

Based on this review, I decided to forgo using a nomination-type measure and instead implement a measure where team members rate the degree to which other team members emulate certain leadership qualities (as indicated by responses using a Likert style response scale). This method mirrors previous research (e.g., Anderson & Wanberg, 1991) and scholars have argued that this method better captures the leader emergence process because it allows for the possibility of multiple emergent leaders (Berdahl, 1996). Moreover, raters are not forced into identifying a sole leader, but instead are encouraged to assess each team member's level of leadership in relation to others. The current effort uses an eight-item measure that represents a modification of previous leader emergence measures (e.g., Kent & Moss, 1994; Lanaj & Hollenbeck, 2015). These items were modified in order to ensure this assessment was behaviorally-based, and to reduce the chances of possible confounds, such as leadership effectiveness. The initial list of modified items was further reviewed by several experts within the leadership domain ($N = 6$) to ensure the items represented leader emergence and were distinguishable from leadership effectiveness.

Based on procedures by Lanaj and Hollenbeck (2015), a round robin design was implemented, whereby each team member answered the set of items in reference to the other team members (Kenny & La Voie, 1984). Sample items include: "[Team Member A] *takes on leadership responsibilities within the team*"; "[Team Member A] *identifies and articulates the team's goals and tasks*"; and "*The team relies on* [Team Member A] *for direction*." The response scale consisted of a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*). Internal consistency (i.e., Cronbach's alpha) values for leader emergence across time and samples are

listed in Table 3 (below). Additionally, rater agreement was assessed by calculating ICC(1) and ICC(2) across raters as well as the average $r^*_{wg(J)}$ value across teams; these values are also depicted in the table below. Parallel to aggregation recommendations (e.g., James, 1982), I computed an individual's leader emergence score from the aggregate across raters. Moreover, *initial leader emergence* reflects leader emergence measured at time period one, while *lagged leader emergence* reflects leader emergence values evaluated at the second time point (approximately three weeks following the initial time point).

Table 3
Scale Reliability Calculations for Leader Emergence

Variable	Sample	Time	Alpha (α)	ICC(1)	ICC(2)	$r^*_{wg(J)}$
Leader emergence	Sample 1	1	0.87	0.85	0.84	0.92
Leader emergence	Sample 1	2	0.95	0.90	0.91	0.86
Leader emergence	Sample 2	1	0.97	0.74	0.75	0.80
Leader emergence	Sample 2	2	0.98	0.75	0.77	0.80

Technical Competence

Technical competence was measured utilizing a self-report measure developed for this study, which consists of five items. Items consist of five categories of skills and abilities representative of technical skills required for the engineering design process. Moreover, these items were developed in conjunction with three subject matter experts (i.e., experienced engineering faculty members who teach the engineering design process). Categories included: electronics experience (e.g., building circuits, repairing electronics, using instruments), crafting experience (e.g., woodworking, model building, prototyping), computer ability (e.g., using Word, Excel, PowerPoint), programming ability (e.g., C/C++, Java, Basic, Fortran, MatLAB, microcontroller), and research experience (e.g., developing surveys, collecting data, identifying research questions). Following similar methods outlined by Liao, Liu, and Loi (2010), respondents indicated their level of experience on a 5-point Likert scale, ranging from 1 (*the*

least competent) to 5 (*the most competent*). Internal consistency values for this scale were as follows: $\alpha = 0.62$ (Sample 1) and $\alpha = 0.46$ (Sample 2).

Table 4
Measurement Plan: Sample 1

Time Point	Semester milestone	Time since previous evaluation	Measures
Time 1	Before announcing teams (during first week)		• Grit [Grit-S scale (Duckworth et al., 2007)] • Assertiveness [Rathus assertiveness schedule (McCormick, 1984)] • Personality [IPIP (Goldberg, 1999)] • Technical competence [self-assessment developed for this study]
Time 2	CATME Evaluation I	~20 days	• Leader emergence [Round robin technique (e.g., Lanaj & Hollenbeck, 2015)] • Leadership effectiveness and likeability [Scale developed by Johnson et al., 2008]
Time 3	CATME Evaluation II	~30 days	• Leader emergence [Round robin technique (e.g., Lanaj & Hollenbeck, 2015)] • Leadership effectiveness and likeability [Scale developed by Johnson et al., 2008]

Table 5
Measurement Plan: Sample 2

Time Point	Month in second semester	Measures
Time 1	January	• Grit [Grit-S scale (Duckworth et al., 2007)] • Assertiveness [Rathus assertiveness schedule (McCormick, 1984)] • Personality [IPIP (Goldberg, 1999)] • Technical competence [self-assessment developed for this study]
Time 2	February	• Leader emergence [Round robin technique (e.g., Lanaj & Hollenbeck, 2015)] • Leadership effectiveness and likeability [Scale developed by Johnson et al., 2008]
Time 3	March	• Leader emergence [Round robin technique (e.g., Lanaj & Hollenbeck, 2015)] • Leadership effectiveness and likeability [Scale developed by Johnson et al., 2008]

Analyses

The current data represents a hierarchical structure, whereby observations of the dependent variable (i.e., leader emergence) are not independent of one another because individuals are nested within teams. Further, because individuals are clustered within teams there is dependency among residuals (Cohen, Cohen, West, & Aiken, 2003). When data is structured in this manner, ordinary least squares (OLS) regression might lead to in accurate inferences. As an alternative, the random coefficient (RC) regression model demonstrates the ability to draw correct inferences from clustered data because of the difference in assumptions made in reference to the correlational structure of data points and the regression coefficients. As such, when clustering is demonstrated, scholars suggest the use of a multilevel model (also referred to as a hierarchical linear model) because this technique implements random coefficient regression (Goldstein, 2011; Kreft & de Leeuw, 1998; Raudenbush & Bryk, 2002; Snijders & Bosker, 1999).

The Need for Multilevel Modeling

Depending on the degree of clustering within a data set, it may lead to negatively biased standard errors of OLS regression coefficients (Cohen et al., 2003). Further, as the level of clustering increases the level of Type I error will increase, leading to *alpha inflation*. In other words, the more similar scores within a cluster (which represents a team in the current study) are, the greater the chances are of obtaining a Type I error. Because the hazards of clustered data lie on a continuum, the first step of conducting analyses with this type of data set includes assessing the level of clustering; this is measured using the *intraclass correlation* (ICC; Shrout & Fleis, 1979). The ICC is representative of the proportion of total variance that is explained by the cluster – in this study, the team. Typically, this statistic ranges from 0 to 1, with 1 referencing

complete dependence. However, in certain instances the ICC statistic can be negative (Cohen, Cohen, West, & Aiken, 2003); this occurs when the level of within-group variance is greater than that of between-group variance. In other words, a negative intraclass correlation coefficient transpires when the variability within groups exceeds the variability across groups; as such, scores within a group vary on account of individual-level noise.

Because the ICC provides an indication of whether context (i.e., cluster, team) has an effect on the outcome, it is common practice determine the need for multilevel modeling by looking to the value of the ICC. If the ICC is small, cluster effects are concluded to be a non-issue; consequently, OLS regression can be implemented, rather than RC regression (Moritz & Watson, 1998 and Kenny & La Voie, 1985). In the current study, ICC(1) across teams was conducted for leader emergence, effectiveness, and likeability (across both time points) using the following equation (Bliese & Halverson, 1998):

$$ICC(1) = \frac{MS_B - MS_W}{MS_B + [(N_G - 1) * MS_W]} \quad \text{(Equation 1)}$$

In this equation, MS_B refers to the between-group mean square and MS_W represents the within-group mean square. Further, N_G denotes the team size. Because the current study utilizes teams with an unequal number of team members (i.e., team size ranges from 4-6), we employed the arithmetic mean of the team sizes for each sample to account for N_G. This was based on procedures identified by Bliese and Halverson (1998), using the following equation:

$$N_G = \frac{1}{k-1}\left(\sum_{i=1}^{k} N_i - \frac{\sum_{i=1}^{k} N_i^2}{\sum_{i=1}^{k} N_i}\right) \quad \text{(Equation 2)}$$

For this equation, k represents the number of groups in the sample and N_i refers to the number of cases in each team. All ICC(1) statistics assessing the amount of variability due to teams was calculated utilizing the R Project for Statistical Computing (version 3.3.3; Team, 2014).

As a second test for the level of dependency among clusters, it is recommended to conduct a model fit test between a baseline model and model in which intercepts vary (Field, Miles, & Field, 2012). If the model fit does not improve when allowing intercepts to vary (as compared to a baseline model containing only the intercept), there is not significant variation across groups; therefore, multilevel modeling is not necessary. When comparing model fit, the current study implemented procedures outlined in Field et al. (2012). Further, when estimating parameters within the regression models, maximum likelihood estimation was used, rather than restricted maximum likelihood. According to Twisk (2006), maximum likelihood estimation leads to more accurate estimates of fixed parameters, while restricted maximum likelihood estimation leads to more precise random variance estimates.

Exploratory Analyses

Personality as assessed by the Big Five personality dimensions. In order to investigate whether grit holds incremental validity above and beyond conscientiousness in relation to leader emergence, I also measured participant personality at the higher-order level utilizing the Big Five personality dimensions (i.e., extraversion, conscientiousness, openness to experience, agreeableness, neuroticism).

The public domain International Personality Item Pool (IPIP) created by Goldberg (1999) was utilized to assess each participant's level of the Big Five. The 50-item self-report instrument was employed, which contains 10 items per trait. Each item was assessed using a 5-point Likert scale, ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Sample items for the Neuroticism

scale include, "*often feel blue*"; "*feel comfortable with myself*"; and "*panic easily*." Sample items for Extraversion include, "*feel comfortable around people*"; "*am skilled in handling social situations*"; and "*don't like to draw attention to myself*." Conscientiousness sample items include, "*am always prepared*"; "*pay attention to details*"; and "*do just enough work to get by*." Sample items for Openness to Experience are "*believe in the importance of art*"; "*enjoy hearing new ideas*"; and "*have a vivid imagination*." Agreeableness example items include, "*have a good word for everyone*"; "*believe that others have good intentions*"; and "*make people feel at ease*." The five personality scales demonstrated adequate levels of reliability and internal consistency values are outlined in Table 6 below.

Table 6
Scale Reliability Calculations for Personality Variables

Variable	**Sample 1 α**	**Sample 2 α**
Openness to experience	0.54	0.89
Extraversion	0.93	0.86
Agreeableness	0.94	0.89
Conscientiousness	0.81	0.88
Neuroticism	0.89	0.91

Leadership Effectiveness and Likeability. In addition to investigating individual differences and leader emergence, data on additional leader evaluations (i.e., leadership effectiveness and likeability) was collected. Specifically, I investigated whether predictors of leader emergence are similar to those of leadership effectiveness and likeability. In doing so, the following research questions will be answered: *Do those that emerge as leaders also perceived well by others? Are similar criteria utilized when rating individuals as effective and likable leaders?*

The leadership effectiveness scale includes three items and was collected using a round robin method, similar to that of the leader emergence scale. The leadership effectiveness items

include the following: "[Team Member A] *is an effective leader.";* "[Team Member A] *succeeds as a team leader*."; and "[Team Member A] *will improve our team performance*." Similarly, likeability was assessed using a scale with three items, consisting of the following: "[Team Member A] *is liked by the other team members*."; "[Team Member A] *is likeable*."; and "*Our team likes working with* [Team Member A]." For both scales, participants indicated whether they agree with the aforementioned statements using a 5-point scale ranging from *strongly agree* to *strongly disagree*. Both the leadership effectiveness and likeability measures have been utilized in previous research (Johnson, Murphy, Zewdie, and Reichard, 2008). Moreover, these leadership criteria measures were assessed at Times 2 and 3. Internal consistency (i.e., Cronbach's alpha) values for leadership effectiveness and likeability across time and samples are listed in Table 7 (below). Additionally, rater agreement as indicated by ICC(1) and ICC(2) values across raters as well as the average $r^*_{wg(J)}$ value across teams are also outlined in the table below. Individual leadership effectiveness and likeability scores were computed as an aggregate across raters.

Table 7
Scale Reliability Calculations for Leadership Criteria

Variable	**Sample**	**Time**	**Alpha (α)**	**ICC(1)**	**ICC(2)**	$r^*_{wg(J)}$
Leadership effectiveness	Sample 1	1	0.90	0.89	0.92	0.83
Leadership effectiveness	Sample 1	2	0.86	0.92	0.94	0.86
Leader likeability	Sample 1	1	0.98	-0.72	-.11	0.92
Leader likeability	Sample 1	2	0.87	-1.71	0.35	0.96
Leadership effectiveness	Sample 2	1	0.94	0.68	0.69	0.82
Leadership effectiveness	Sample 2	2	0.95	0.68	0.68	0.78
Leader likeability	Sample 2	1	0.94	0.52	0.53	0.94
Leader likeability	Sample 2	2	0.95	0.62	0.62	0.94

Gender. As previously mentioned, both empirical and meta-analytic (Barling, 2014; Berdhal, 1996; Eagly & Karau, 1991) research indicates that men are more likely to emerge as leaders as compared to women. This phenomenon can be partially explained by social role

theory which posits that because men are perceived to embody traits that are stereotypical of a leader (e.g., assertive, dominant), that others will look to them as leaders to a greater degree than that of women (also parallel to stereotypes whereby women are regarded as possessing more communal, or socially-oriented traits). As an exploratory analysis, I investigated whether this gender discrepancy also holds true in the context self-managed teams. In opposition to the aforementioned research and theory, I argue that women will not experience lower levels of leader emergence within this context, particularly when leader emergence is measured at a later time point, following repeated team member interactions. In their meta-analytic investigation, Eagly and Karau (1991) found initial evidence to suggest that the incongruity between male and female leader emergence pacified as team members worked together for a longer period of time. The current context represents one in which teams collaborate with one another over several months, thereby increasing the amount of team member interactions and potentially reducing the gender leader emergence disparity. Further bolstering this argument is the underlying nature of a self-managed team. Rather than a leader being formally designated by someone outside or within the team, individuals are perceived to be leader-like by their fellow team members and possess the ability to influence others on the team because they are chosen to do so. As such, it could be argued that within the context of a self-managed team, a leader is more likely to be identified based on their merit and fit for the position, rather than simply being appointed to the role. To investigate whether this holds true, I will explore whether gender demonstrates predictive validity for leader emergence.

For the current study, gender was assessed via self-report. Participants indicated whether they identified with being *male* or *female*, and this variable was included in analyses as a dummy variable such that men were coded 0 and women were coded 1. For Sample 1, there were 11

males (84.6%) and 2 females (15.4%), while Sample 2 had 28 males (58.3%) and 20 females (41.7%).

CHAPTER SIX: Results

Preliminary Analyses

Confirming the Structure of the Leadership Criteria Measures

Before executing the primary analyses, I conducted a series of confirmatory factor analyses (CFA) in order to confirm the factor structure of the leader emergence measure and to further distinguish this leadership criteria from leadership effectiveness and likeability. Participants for this study included all participants from Sample 2 that completed the Time 1 leadership criteria measures (i.e., leader emergence, effectiveness, and likeability). As previously mentioned, in addition to rating others on the three leadership criteria, participants also provided responses regarding their perceptions of their own leadership qualities. The sample consisted of 78 individuals with 44 (56.4%) males and 34 (43.6%) females. The average age was 21.42 (*SD*=0.57)[3].

The theoretical model (denoted Model 1) consisting of three factors (i.e., leader emergence, leadership effectiveness, leader likeability) fit the data well (RMSEA=.08, TLI = .97, CFI = .98, SRMR = .08). According to Hu and Bentler (1998), Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) values below .90 indicate poor model fit, .90 - .95 marginal fit, and above .95 indicate the model demonstrates good fit. Further, Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Square Residual (SRMR) values above .90 indicates poor fit, .08 - .06 marginal fit, and below .06 indicate good fit. These fit indices cutoffs were utilized when determining model fit for the aforementioned model. The chi-square test statistic was not utilized to inform model fit as researchers have concluded that this fit index

[3] This sample is greater than the sample included in the final test of hypotheses (*N*=48) because the latter included only those participants from teams where all team members provided leadership ratings.

if sample-size dependent, thereby resulting in inflated values when a large sample size is utilized (Brannick, 1995; Kelloway, 1995; Meade, Johnson, and Braddy, 2008).

Model 1 (i.e., the three-factor model) was then compared to two additional CFA models to ensure leader emergence exhibits discriminant validity from leadership effectiveness and likeability. Model 2 consisted of two factors, where leader emergence and effectiveness where collapsed onto one factor and Model 3 consisted of one factor, where all items loaded onto a leadership criterion factor. Both Model 2 (RMSEA=.11, TLI = .93, CFI = .94, SRMR = .10) and Model 3 (RMSEA=.21, TLI = .79, CFI = .82, SRMR = .15) demonstrated relatively poorer fit as compared to Model 1. The difference in fit was significant as the change in CFA between Model 1 and both models was greater than .002 (Meade, Johnson, & Braddy, 2008). These results provide support for the discriminant validity of leader emergence, effectiveness, and likeability as assessed using the three measures utilized in the current study. All models were estimated in LISREL 8.80 (Jöreskog & Sörbom, 1996); fit indices and model figures are depicted in Table 8 and Figure 3, respectively.

Table 8

Confirmatory Factor Analysis Results: Leadership Criteria

Model	Factors	χ^2	*df*	RMSEA (90%CI)	TLI	CFI	SRMR	ΔCFI
Model 1	Leader emergence, effectiveness, likeability	101.18*	74	0.08 (0.043; 0.11)	0.97	0.98	0.08	
Model 2	Leadership effectiveness, likeability	151.24*	76	0.11 (0.087; 0.14)	0.93	0.94	0.10	0.04
Model 3	Leadership	333.96*	77	0.21 (0.19; 0.23)	0.79	0.82	0.15	0.12

Notes. RMSEA = Root Mean Square Error of Approximation; 90% CI = lower and upper 90% confidence interval; TLI = Tucker-Lewis Index; CFI = Comparative Fit Index; SRMR = Standardized Root Mean Square Residual.

*$p<.05$

Table 9

Confirmatory Factor Analysis Results: Grit

Model	Factors	χ^2	*df*	RMSEA (90%CI)	TLI	CFI	SRMR	ΔCFI
Model 1	Consistency, perseverance	101.32*	53	0.11(0.08; 0.14)	0.87	0.90	0.12	
Model 2	Grit	247.55*	54	0.21 (0.19; 0.24)	0.63	0.70	0.18	0.20

Notes. RMSEA = Root Mean Square Error of Approximation; 90% CI = lower and upper 90% confidence interval; TLI = Tucker-Lewis Index; CFI = Comparative Fit Index; SRMR = Standardized Root Mean Square Residual.

*$p<.05$

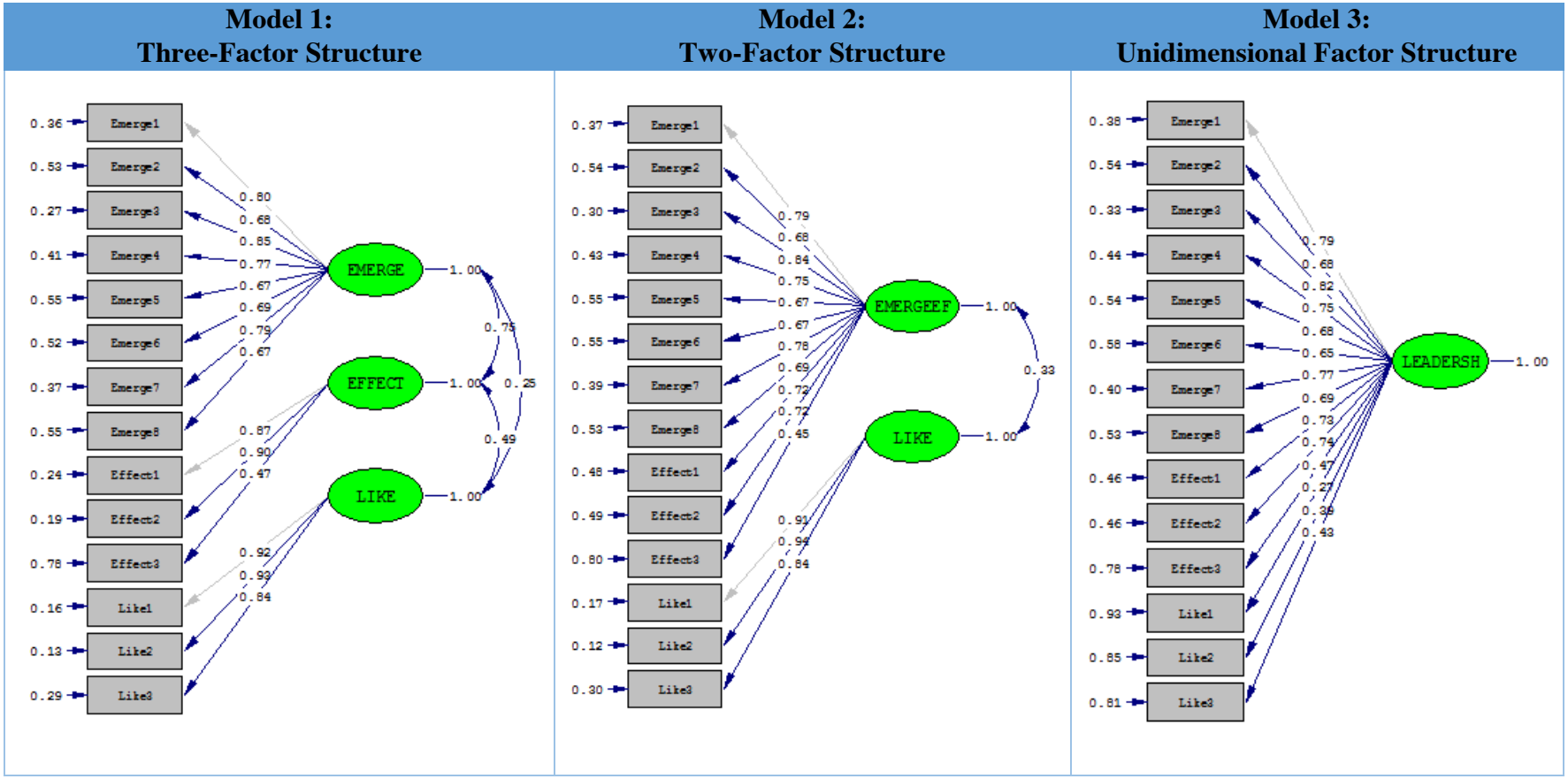

Figure 3. Tested confirmatory factor analysis models and respective item loadings: Leadership criteria.

Confirming the Structure of the Grit Measure

As previously discussed, Credé and colleagues (2016) provided meta-analytic evidence supporting a two-factor structure for the construct of grit specifically consisting of *consistency* and *perseverance*. Findings further indicated that combining both factors results in lower predictive validity in regards to academic and nonacademic performance as perseverance displays a greater amount of predictive validity as compared to consistency. As such, in order to maximize utility, grit should be considered as a multidimensional construct. The current study employs this measurement structure, and assessed grit as two distinct factors: grit-perseverance and grit-consistency. In order to provide evidence for a two-factor structure, I conducted a model comparison.

Participants included those from Sample 2 that completed the initial series of independent variables (i.e., assertiveness, grit, technical competence, and personality as measured by the Five Factor model). The sample consisted of 79 individuals with 45 (57%) males and 33 (41.8%) females. The average age was 21.42 (*SD*=0.57).

Results indicate that Model 1 (i.e., two-factor model) displays greater fit than Model 2 (i.e., unidimensional model), and this difference is significant as the change in CFI is greater than .002 (Meade, Johnson, & Braddy, 2008). Based on this, it can be concluded that grit consists of two factors, perseverance and consistency. Model 1 and Model 2 are depicted in Figure 4 (below), respectively; fit indices are identified in Table 9 (above).

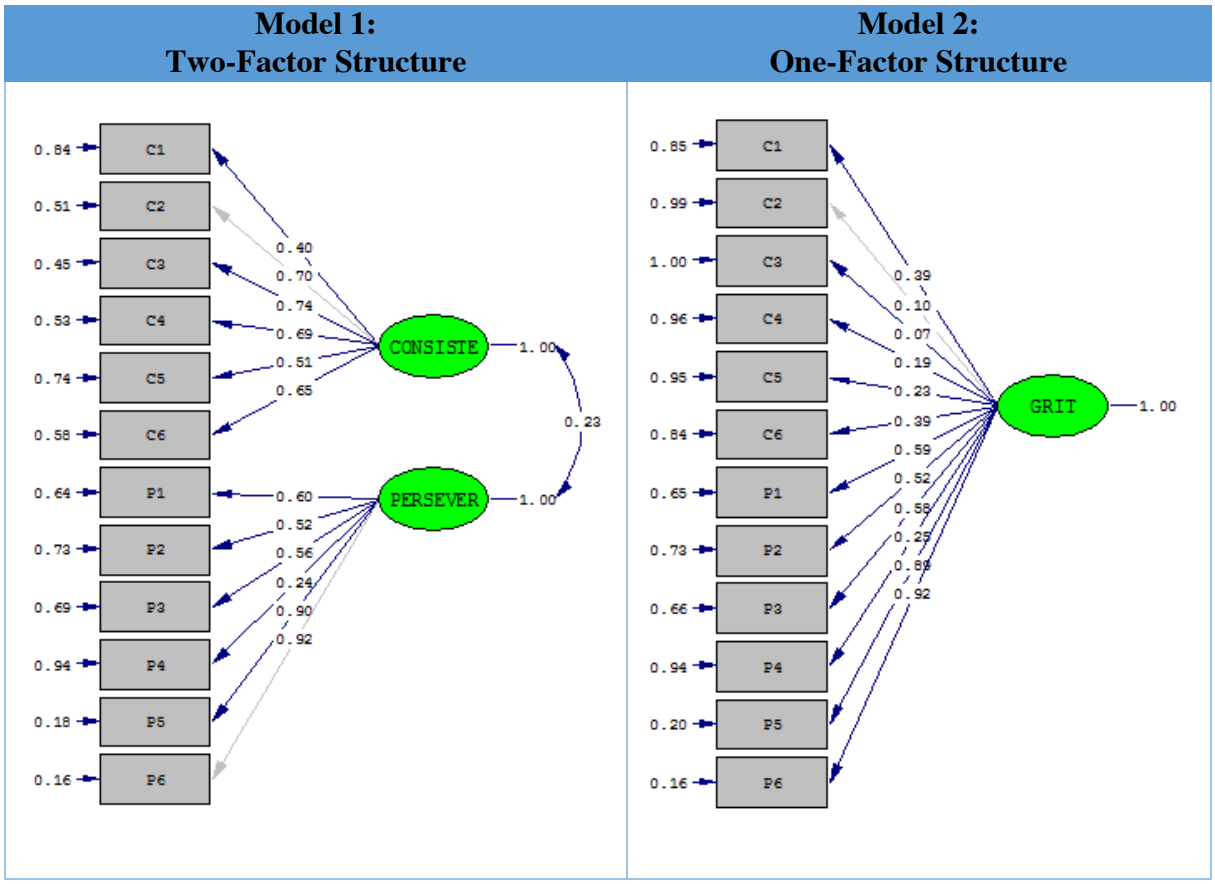

Figure 4. Tested confirmatory factor analysis models and respective item loadings: Grit.

Assessing the Presence of Variation by Teams

As discussed in the methods section, before implementing HLM procedures, it is useful to identify the degree to which a dependent variable is explained by the context variable. First, intraclass correlation coefficients, ICC(1), across teams were calculated for leader emergence, effectiveness, and likeability across time points and samples. ICC(1) values reflect the degree to which context (in this sample context represents the team) explains the dependent variable. Table 10 contains the calculated ICC(1) values, which (except for leader likeability at Time 1 and Time 2 for Sample 1) are low, indicating that context does not have a strong effect.

Table 10
ICC(1) Calculations for Leadership Criteria

Variable	**Sample**	**Time**	**ICC(1)***
Leader emergence	Sample 1	1	0.03
Leader emergence	Sample 1	2	0.00
Leadership effectiveness	Sample 1	1	0.29
Leadership effectiveness	Sample 1	2	-0.03
Leader likeability	Sample 1	1	0.66
Leader likeability	Sample 1	2	0.73
Leader emergence	Sample 2	1	-0.17
Leader emergence	Sample 2	2	-0.14
Leadership effectiveness	Sample 2	1	-0.11
Leadership effectiveness	Sample 2	2	-0.13
Leader likeability	Sample 2	1	0.03
Leader likeability	Sample 2	2	0.32

**Note*. The ICC(1) value calculated here is different than the ICC(1) value calculated in the measurement section. The previous values in the measurement section reflect rater agreement, while these values reflect the amount of variability in the corresponding dependent variable due to each team.

Secondly, I conducted a series of model difference tests investigating the change in model fit between two models: (a) a baseline model containing only the intercept and (b) a model that allowed intercepts to vary by team. This model difference test was performed for each dependent variable (i.e., leader emergence, effectiveness, and likeability) across time and within both samples. Results are depicted in Table 11.

Table 11
Tests for Intercept Variability

Sample	Time	Variable	Model	BIC	LogLik	Test	L.Ratio	p-val
1	1	Emerge	1	18.84	-6.86			
1	1	Emerge	2	21.41	-6.86	1 vs 2	8.42	>.05
1	2	Emerge	1	22.09	-8.48			
1	2	Emerge	2	24.65	-8.48	1 vs 2	1.58	>.05
1	1	Effect	1	25.12	-1.00			
1	1	Effect	2	27.68	-1.00	1 vs 2	1.58	>.05
1	2	Effect	1	27.27	-11.07			
1	2	Effect	2	29.84	-11.07	1 vs 2	1.58	>.05
1	1	Like	1	4.35	0.39			
1	1	Like	2	6.91	0.39	1 vs 2	4.49	>.05
1	2	Like	1	-5.87	5.50			
1	2	Like	2	-3.31	5.50	1 vs 2	1.58	>.05
2	1	Emerge	1	105.91	-49.11			
2	1	Emerge	2	109.76	-49.11	1 vs 2	1.21	>.05
2	2	Emerge	1	105.33	109.03			
2	2	Emerge	2	107.33	112.88	1 vs 2	1.24	>.05
2	1	Effect	1	96.53	-44.41			
2	1	Effect	2	100.38	-44.41	1 vs 2	1.53	>.05
2	2	Effect	1	103.47	-47.88			
2	2	Effect	2	107.32	-47.88	1 vs 2	1.22	>.05
2	1	Like	1	30.99	-11.65			
2	1	Like	2	34.84	-11.65	1 vs 2	6.99	>.05
2	2	Like	1	30.56	-11.43			
2	2	Like	2	34.41	-11.43	1 vs 2	7.44	>.05

Notes. Model 2 contains random intercepts, BIC= Bayesian information criterion, LogLik =Log Liklihood, p-val = *p*-value.

Test of Hypotheses

Descriptive Statistics and Inter-Correlations

Table 12 contains the zero-order correlations, means, and standard deviations for all variables in Sample 1 and Table 13 contains those for Sample 2. Moreover, Appendix E and Appendix F contain histograms for each dependent variable (i.e., leader emergence, effectiveness, and likeability), depicting the distributions in the current data sets.

Table 12

Descriptive Statistics and Zero-Order Correlations among Study Variables (Sample 1)

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Assertiveness	2.91	0.65															
2. Grit-Consistency	3.04	0.43	0.63*														
3. Grit-Perseverance	4.00	0.44	0.31	0.44													
4. Tech Competence	2.62	0.72	0.38	0.02	0.40												
5. Neuroticism	2.68	0.85	-0.40	-0.36	-0.44	-0.46											
6. Extraversion	2.76	0.85	0.53	0.48	0.60*	0.09	-0.44										
7. Conscientiousness	3.65	0.55	-0.07	-0.08	0.33	0.33	-0.02	-0.17									
8. Openness	3.67	0.51	-0.04	0.13	0.64*	0.05	-0.33	0.49	0.33								
9. Agreeableness	3.80	0.81	-0.63*	-0.27	0.07	-0.25	-0.02	0.14	-0.05	0.25							
10. Gender	0.15	0.38	-0.39	-0.38	0.08	0.11	0.25	0.02	0.52	0.29	0.30						
11. Emergence T1	3.23	0.47	0.28	0.17	0.62*	0.14	-0.30	0.21	0.56*	0.47	-0.03	-0.06					
12. Effect T1	3.65	0.68	0.48	0.35	0.68*	0.28	-0.43	0.31	0.48	0.35	-0.15	-0.24	0.93*				
13. Likeability T1	4.27	0.41	0.50	0.31	0.67*	0.34	-0.56*	0.60*	0.23	0.28	0.11	-0.05	0.71*	0.80*			
14. Emergence T2	3.45	0.53	0.13	0.14	0.66*	0.14	-0.19	0.26	0.50	0.39	0.17	0.04	0.86*	0.78*	0.61*		
15. Effect T2	3.69	0.64	0.16	0.26	0.63*	0.16	-0.13	0.15	0.55	0.30	0.06	-0.09	0.83*	0.82*	0.55	0.94*	
16. Likeability T2	4.21	0.31	0.22	0.39	0.31	0.03	-0.14	0.27	0.13	-0.11	0.28	-0.30	0.36	0.55	0.60*	0.35	0.51

Notes. Tech Competence = technical competence, Emergence = Leader emergence, Effect = Leadership effectiveness, Likeability = Leader likeability, T1 = Time 1, T2 = Time 2.

$N = 13$

*$p<.05$.

Table 13

Descriptive Statistics and Zero-Order Correlations among Study Variables (Sample 2)

Variable	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Assertiveness	3.07	0.49															
2. Grit-Consistency	3.09	0.65	0.17														
3. Grit-Perseverance	3.67	0.75	-0.04	0.28													
4. Tech Competence	3.40	0.62	0.20	0.24	0.26												
5. Neuroticism	2.55	0.82	-0.18	-0.20	-0.41*	-0.19											
6. Extraversion	3.36	0.66	0.33*	-0.12	0.15	0.13	-0.14										
7. Conscientiousness	3.46	0.70	0.19	0.31*	0.71*	0.22	-0.45*	0.11									
8. Openness	3.75	0.84	-0.15	-0.03	0.55*	0.24	-0.24	0.24	0.34*								
9. Agreeableness	3.71	0.74	-0.15	0.10	0.66*	0.19	-0.54*	0.08	0.52*	0.75*							
10. Gender	0.42	0.50	0.01	0.08	0.34*	0.29*	-0.02	0.35*	0.20	0.27	0.20						
11. Emergence T1	3.34	0.70	0.25	0.15	0.32*	0.31*	-0.19	0.16	0.37*	-0.03	0.16	0.17					
12. Effect T1	3.74	0.64	0.24	0.14	0.38*	0.31*	-0.33*	0.11	0.44*	-0.01	0.19	0.10	0.93*				
13. Likeability T1	4.41	0.33	0.06	0.05	0.19	0.39*	-0.02	-0.01	0.18	0.08	0.09	0.06	0.55*	0.54*			
14. Emergence T2	3.35	0.73	0.24	0.12	0.31*	0.31*	-0.21	0.16	0.39*	0.04	0.17	0.20	0.95*	0.92*	0.58*		
15. Effect T2	3.68	0.69	0.20	0.17	0.23	0.21	-0.20	0.09	0.34*	-0.06	0.10	0.09	0.88*	0.89*	0.53*	0.92*	
16. Likeability T2	4.27	0.39	0.09	0.21	-0.02	0.28	-0.07	-0.14	0.21	-0.09	-0.03	-0.17	0.38*	0.40*	0.74*	0.46*	0.51*

Notes. Tech Competence = technical competence, Emergence = Leader emergence, Effect = Leadership effectiveness, Likeability = Leader likeability, T1 = Time 1, T2 = Time 2.

$N = 48$

*$p<.05$.

In order to test Hypotheses 1-6, a series of hierarchical linear models were conducted. The majority of the ICC(1)s were low and the series of model difference tests were insignificant, meaning there was not a significant change in model fit between Model 1 (which did not allow intercepts to vary) and Model 2 (which allowed random intercepts for each team). Based on this, it could be interpreted that in both Sample 1 and Sample 2, the context (i.e., team) did not have an effect on leadership criteria. However, hierarchical linear modeling (rather than ordinary least squares regression) was still employed because the data reflected group mean centered values, rather than raw data points. Group mean centering reflects a process by which the team's mean level of a certain variable is taken into account when determining an individual's score of the same variable. For example, if an individual's raw score is 3 and the mean of this variable for the team they are on is 2, then their group mean centered score would be 1. Based on recommendations by Enders and Tofighi (2007), this data transformation process was implemented because the primary research question is better explained by group centered data. Specifically, by group centering the data, we can draw inferences regarding one's level of the independent and dependent variables relative to their team members, rather than comparing them to the sample as a whole. Further, the data also lends itself to this transformation method because all variables of interest are at level one (i.e., the individual) (Enders & Tofighi, 2007).

Hypothesis 1

Hypothesis 1 predicted that an individual's level of initial leader emergence (measured at Time 1) would be different than their level of lagged leader emergence (measured at Time 2). As referenced in Tables 13 and 14, the correlation between initial and lagged leader emergence is strong in both Sample 1 (r = .83, p<.05) and Sample 2 (r =.96, p <.05), indicating that these two values are related. As an additional test of this relationship, I regressed lagged leader emergence

onto initial leader emergence and found initial leader emergence to be a significant predictor in both Sample 1 ($B = 0.85, p<.05$), and Sample 2, ($B = 0.98, p<.05$) after accounting for the additional independent variables (i.e., technical competence, grit, and assertiveness) (see Table 14). Further, as is indicated by the graphs depicting this relationship within Sample 1 and 2 (Figures 5 and 6 below), it appears to be stable across teams. As such, Hypothesis 1 was not supported[4].

Table 14
Summary of Regression Analysis for Model Where Lagged Leader Emergence is Regressed onto Initial Leader Emergence, While Controlling for Independent Variables

	Sample 1			Sample 2		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Intercept	0.00	0.09	0.00	0.00	0.03	0.00
Initial leader emergence	0.85*	0.31	0.75*	0.98*	0.05	0.94*
Assertiveness	-0.15	0.35	-0.18	-0.06	0.07	-0.04
Grit-Consistency	0.01	0.63	0.01	-0.08	0.07	-0.07
Grit-Perseverance	0.26	0.54	0.22	0.08	0.08	0.08
Technical Competence	0.01	0.18	0.01	0.10	0.06	0.08
R^2	0.64			0.92		

Notes. *B* = unstandardized coefficient, *SE* = standard error, *β* = standardized coefficient, R^2 = Level 1 variance explained by predictors.
*$p<.05$.

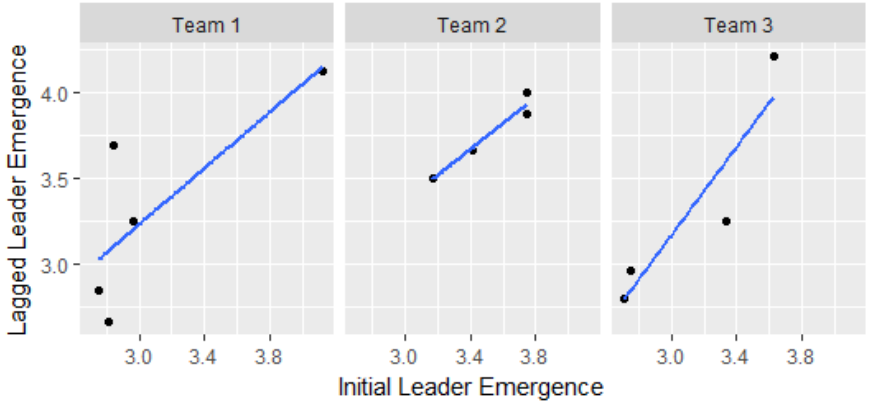

Figure 5. Lagged leader emergence regressed onto initial leader emergence in Sample 1.

[4] Because of the strong relationship between initial and lagged leader emergence, subsequent models do not include initial leader emergence as a control variable.

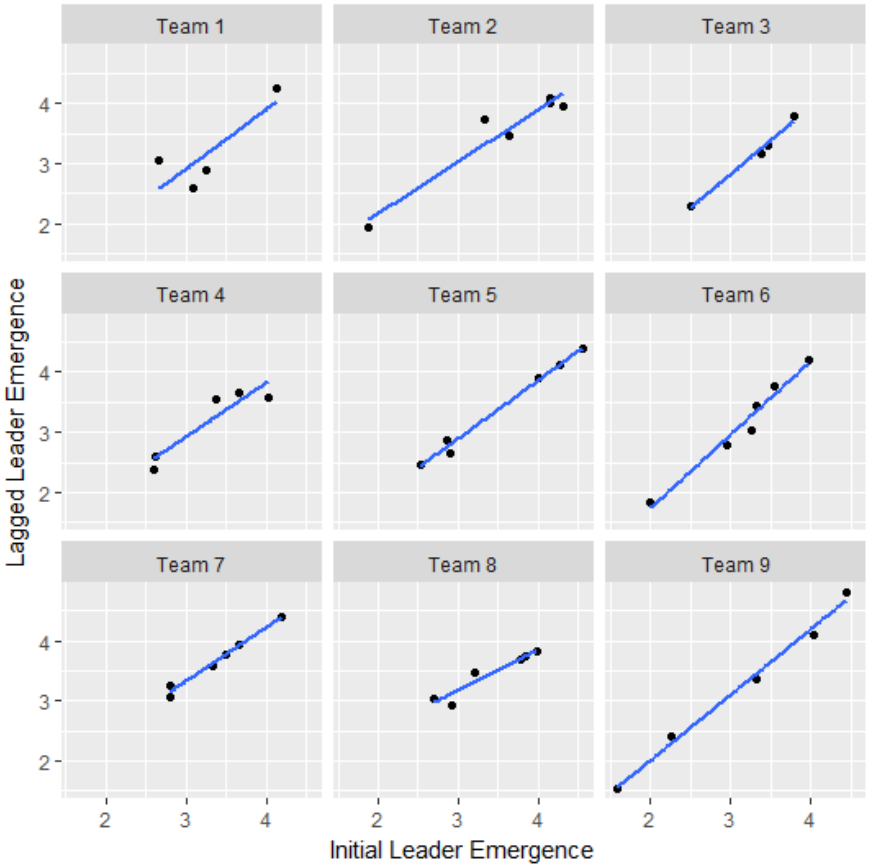

Figure 6. Lagged leader emergence regressed onto initial leader emergence in Sample 2.

Hypothesis 2

In support for Hypothesis 2, which posited that assertiveness would positively predict initial leader emergence, an individual's relative level of assertiveness had a significant effect on initial leader emergence in Sample 2 ($B = 0.49, p < .05$). However, as indicated by the model comparisons between Models 1-3 (see Table 15 for results), this effect became non-significant after accounting for grit and technical competence (see Model 3). Relatedly, the semipartial correlation coefficient (sr^2) for assertiveness was low (calculated from the change in R^2 from Model 2 to Model 3). As such, the variance within initial leader emergence explained by assertiveness is not unique. Hypothesis 2 was also not supported in Sample 1; however, it is important to note that conclusions drawn from Sample 1 should be interpreted with caution being

that the number of participants was fairly low (*N*=13), indicating a low level of power. Results are outlined in Table 16, and Figures 7 and 8 provide graphs depicting the relationship between assertiveness and initial leader emergence across teams.

Table 15
Summary of Regression Analysis for Variables Predicting Initial Leader Emergence: Sample 1

	Model 1			Model 2			Model 3		
Variable	*B*	*SE B*	β	*B*	*SE B*	β	*B*	*SE B*	β
Intercept	0.00	.012	0.00	0.00	0.11	0.00	0.00	0.10	0.00
Assertiveness	0.08	0.22	0.11				0.62	0.34	0.86
Grit-Consistency				-0.23	0.37	0.23	-1.15	0.60	-1.05
Grit-Perseverance				0.76 †	0.39	0.76 †	1.25*	0.43	1.17*
Technical Competence				-0.10	0.20	-0.09	-0.23	0.19	-0.35
R^2	0.01			0.26			0.42		

Notes. *B* = unstandardized coefficient, *SE* = standard error, β = standardized coefficient, R^2 = Level 1 variance explained by predictors.
*p<.05, †p<.10.

Table 16
Summary of Regression Analysis for Variables Predicting Initial Leader Emergence: Sample 2

	Model 1			Model 2			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β	*B*	*SE B*	β
Intercept	-0.00	0.10	0.00	0.00	0.09	0.00	-0.00	0.09	0.00
Assertiveness	0.49*	0.23	0.34*				0.22	0.22	0.15
Grit-Consistency				0.17	0.20	-0.17	-0.15	0.20	-0.14
Grit-Perseverance				0.80*	0.23	0.80*	0.74*	0.24	0.79*
Technical Competence				0.18	0.17	0.18	0.14	0.17	0.12
R^2	0.09			0.27			0.28		

Notes. *B* = unstandardized coefficient, *SE* = standard error, β = standardized coefficient, R^2 = Level 1 variance explained by predictors.
*p<.05.

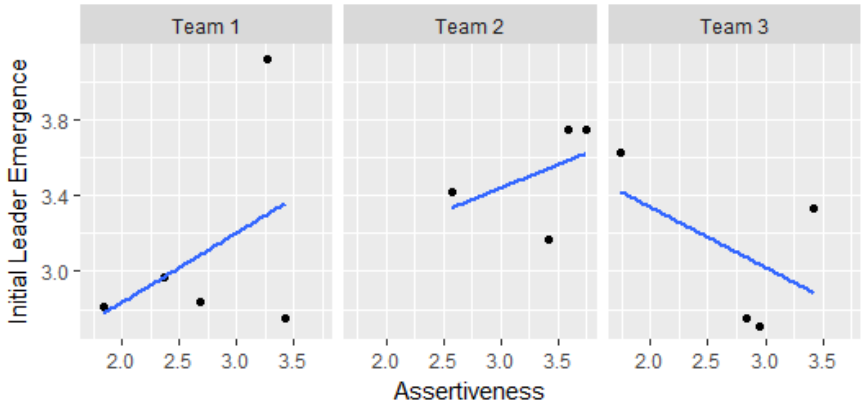

Figure 7. Initial leader emergence regressed onto assertiveness in Sample 1.

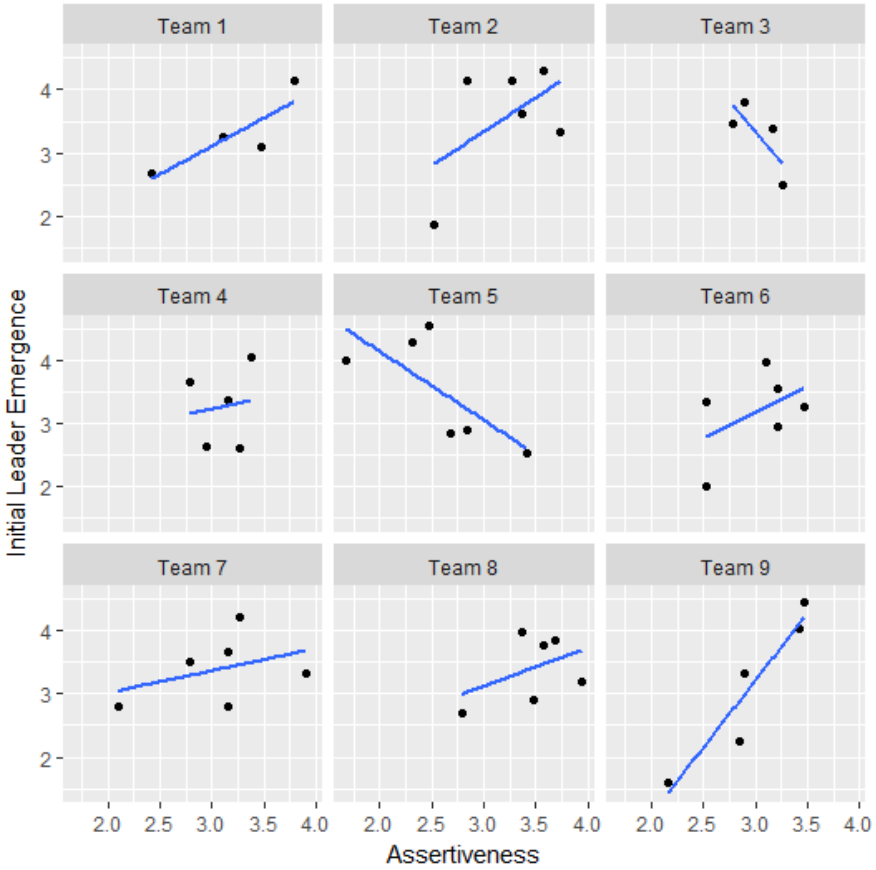

Figure 8. Initial leader emergence regressed onto assertiveness in Sample 2.

Hypothesis 3

For Hypothesis 3, I argued that grit would positively predict lagged leader emergence. In support of this, results indicated that grit-perseverance significantly predicted lagged leader

emergence in both Sample 1 (B= 1.32, $p < .05$) and Sample 2 ($B = 0.80$, $p < .05$), after accounting for the additional independent variables. The relationship between grit-perseverance and lagged leader emergence is plotted in Figures 9 and 10. Grit-consistency was not a significant predictor across samples (see Tables 17 and 18).

Table 17
Summary of Regression Analysis for Variables Predicting Lagged Leader Emergence: Sample 1

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Intercept	0.00	0.12	0.00	-0.12	0.20	0.00
Assertiveness	0.39	0.40	0.48	0.48	0.45	0.59
Grit-Consistency	-0.96	0.71	-0.78	-0.62	1.01	-0.50
Grit-Perseverance	1.32*	0.51	1.10*	0.95	0.70	0.79
Technical Competence	-0.18	0.22	-0.24	-0.03	0.25	-0.04
Grit-Consistency x assertiveness				1.41	1.19	0.48
Grit-Perseverance x assertiveness				-0.87	0.95	-0.27
Technical Competence x assertiveness				-0.79	0.56	-0.32
R^2	0.38			0.47		

Notes. B = unstandardized coefficient, SE = standard error, β = standardized coefficient, R^2 = Level 1 variance explained by predictors.
*p<.05.

Table 18
Summary of Regression Analysis for Variables Predicting Lagged Leader Emergence: Sample 2

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Intercept	-0.00	0.09	0.00	0.04	0.10	0.00
Assertiveness	0.16	0.23	0.11	0.13	0.18	0.11
Grit-Consistency	-0.23	0.20	-0.20	-0.25	0.21	-0.22
Grit-Perseverance	0.80*	0.25	0.82*	0.79*	0.26	0.81*
Technical Competence	0.15	0.18	0.13	0.13	0.24	0.09
Grit-Consistency x assertiveness				-0.11	0.48	-0.11
Grit-Perseverance x assertiveness				-0.21	0.59	-0.19
Technical Competence x assertiveness				-0.40	0.51	-0.44
R^2	0.27			0.28		

Notes. B = unstandardized coefficient, SE = standard error, β = standardized coefficient, R^2 = Level 1 variance explained by predictors.
*p<.05.

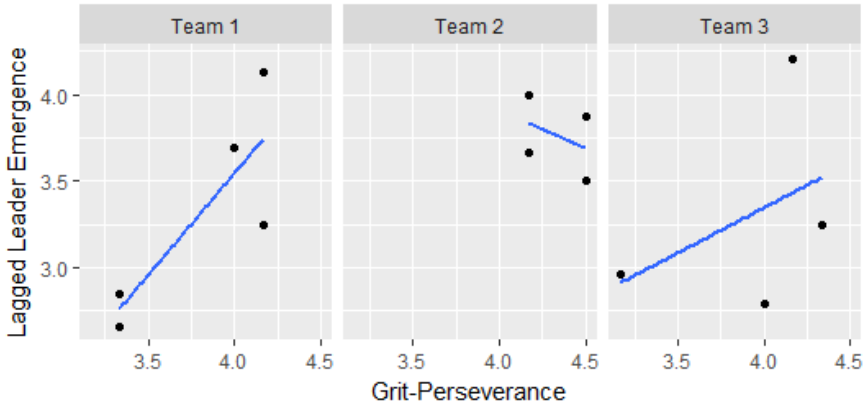

Figure 9. Lagged leader emergence regressed onto grit-perseverance in Sample 2.

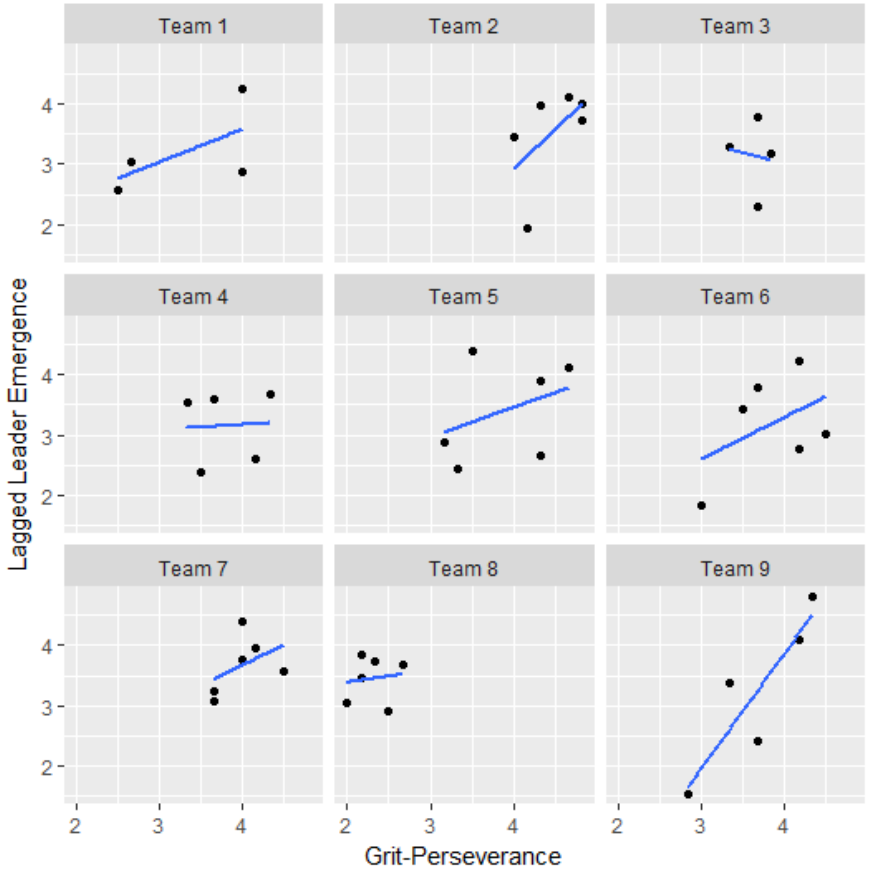

Figure 10. Lagged leader emergence regressed onto grit-perseverance in Sample 1.

Hypothesis 4

Hypothesis 4 stated that technical competence would positively predict lagged leader emergence. This relationship was not found for either Sample 1 (B = -0.18, p > .05) or Sample 2

($B = 0.15, p > .05$) as technical competence did not significantly predict lagged leader emergence after accounting for grit-consistency, grit-perseverance, and assertiveness. See Tables 17 and 18, above, for results.

Hypotheses 5 and 6

Both Hypothesis 5 and 6 represented the interactions between independent variables. According to Hypothesis 5, it was theorized that grit would interact with the relationship between assertiveness and lagged leader emergence. Relatedly, Hypothesis 6 predicted that technical competence would interact with assertiveness and lagged leader emergence. As indicated by the results in Tables 17 and 18, the interaction terms did not have a significant effect on lagged leader emergence, after accounting for the main effects. As such, Hypotheses 5 and 6 were not supported in both Sample 1 and Sample 2.

Exploratory Analyses

Leadership Effectiveness and Likeability

In addition to assessing the relationships between several individual difference characteristics and leader emergence, I also tested whether these relationships hold for leadership effectiveness and likeability. As such, several hierarchical linear models were conducted whereby leadership effectiveness and likeability were regressed onto grit, assertiveness, and technical competence. Tables 19-26 outlines the results.

Grit-perseverance significantly predicted both initial and lagged leadership effectiveness in Sample 2 ($B = 0.67$ and 0.63, respectively, $p < .05$). Further, technical competence significantly predicted initial leader likeability in Sample 2 ($B = 0.18, p < .05$).

Table 19

Summary of Regression Analysis for Variables Predicting Initial Leadership Effectiveness: Sample 1

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Intercept	0.00	0.12	0.00	0.08	0.47	0.00
Assertiveness	0.84†	0.42	0.80†	0.82	0.46	0.78
Grit-Consistency	-1.25	0.74	-0.79	-1.25	0.79	-0.79
Grit-Perseverance	1.49*	0.53	0.96*	1.50*	0.57	0.97*
Technical Competence	-0.15	0.23	-0.16	-0.15	0.25	-0.16
Gender				-0.07	0.40	-0.04
R^2	0.45			0.42		

Notes. *B* = unstandardized coefficient, SE = standard error, β = standardized coefficient, R^2 = Level 1 variance explained by predictors.
*p<.05, $^{\dagger}p$<.10.

Table 20

Summary of Regression Analysis for Variables Predicting Initial Leadership Effectiveness: Sample 2

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Intercept	-0.00	0.08	0.00	-0.02	0.24	0.00
Assertiveness	0.13	0.19	0.10	0.16	0.15	0.12
Grit-Consistency	-0.10	0.17	-0.10	-0.12	0.18	-0.12
Grit-Perseverance	0.67*	0.21	0.79*	0.67*	0.21	0.79*
Technical Competence	0.16	0.15	0.16	0.13	0.20	0.13
Gender				0.02	0.16	0.02
R^2	0.29			0.28		

Notes. *B* = unstandardized coefficient, SE = standard error, β = standardized coefficient, R^2 = Level 1 variance explained by predictors.
*p<.05, $^{\dagger}p$<.10.

Table 21

Summary of Regression Analysis for Variables Predicting Lagged Leadership Effectiveness: Sample 1

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Intercept	0.00	0.14	0.00	-0.00	0.54	0.00
Assertiveness	0.55	0.47	0.56	0.55	0.52	0.56
Grit-Consistency	-1.25	0.83	-0.84	-1.25	0.89	-0.84
Grit-Perseverance	1.65*	0.60	1.13*	1.65*	0.64	1.13*
Technical Competence	-0.10	0.26	-0.11	-0.10	0.28	-0.11
Gender				0.00	0.45	0.00
R^2	0.42			0.39		

Notes. *B* = unstandardized coefficient, SE = standard error, β = standardized coefficient, R^2 = Level 1 variance explained by predictors. *p<.05.

Table 22

Summary of Regression Analysis for Variables Predicting Lagged Leadership Effectiveness: Sample 2

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Intercept	-0.00	0.09	0.00	-0.09	0.29	0.00
Assertiveness	0.09	0.23	0.06	0.07	0.18	0.05
Grit-Consistency	-0.11	0.21	-0.10	-0.11	0.21	-0.10
Grit-Perseverance	0.63*	0.25	0.68*	0.62*	0.26	0.67*
Technical Competence	0.08	0.18	0.07	0.08	0.24	0.07
Gender				0.06	0.19	0.04
R^2	0.17			0.17		

Notes. *B* = unstandardized coefficient, SE = standard error, β = standardized coefficient, R^2 = Level 1 variance explained by predictors.

*p<.05.

Table 23

Summary of Regression Analysis for Variables Predicting Initial Leader Likeability: Sample 1

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Intercept	0.00	0.07	0.00	-0.25	0.24	0.00
Assertiveness	0.17	0.23	0.27	0.23	0.24	0.17
Grit-Consistency	-0.16	0.41	-0.17	-0.17	0.41	-0.16
Grit-Perseverance	0.41	0.30	0.44	0.37	0.30	0.41
Technical Competence	-0.06	0.13	-0.11	-0.06	0.13	-0.06
Gender				0.21	0.21	0.17
R^2	0.23			0.28		0.23

Notes. *B* = unstandardized coefficient, SE = standard error, β = standardized coefficient, R^2 = Level 1 variance explained by predictors.

*p<.05.

Table 24

Summary of Regression Analysis for Variables Predicting Initial Leader Likeability: Sample 2

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Intercept	-0.00	0.04	0.00	0.06	0.13	0.00
Assertiveness	0.00	0.10	0.00	0.18*	0.08	0.27*
Grit-Consistency	-0.05	0.09	-0.10	-0.05	0.09	-0.10
Grit-Perseverance	0.18	0.11	0.41	0.19†	0.11	0.43†
Technical Competence	0.18*	0.08	0.34*	0.01	0.10	0.02
Gender				-0.04	0.09	-0.06
R^2	0.20			0.20		

Notes. *B* = unstandardized coefficient, SE = standard error, β = standardized coefficient, R^2 = Level 1 variance explained by predictors.

*p<.05, $^{\dagger}p$<.10.

Table 25
Summary of Regression Analysis for Variables Predicting Lagged Leader Likeability: Sample 1

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Intercept	0.00	0.05	0.00	-0.23	0.18	0.00
Assertiveness	0.04	0.18	0.08	0.09	0.18	0.14
Grit-Consistency	-0.13	0.32	-0.18	-0.15	0.30	-0.16
Grit-Perseverance	0.17	0.23	0.24	0.13	0.22	0.14
Technical Competence	0.03	0.10	0.07	0.03	0.09	0.05
Gender	0.08			0.20	0.15	0.19
R^2	0.23			0.19		

Notes. *B* = unstandardized coefficient, SE = standard error, β = standardized coefficient, R^2 = Level 1 variance explained by predictors.
*p<.05.

Table 26
Summary of Regression Analysis for Variables Predicting Lagged Leader Likeability: Sample 2

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Intercept	0.00	0.04	0.00	0.14	0.13	0.00
Assertiveness	-0.01	0.12	-0.01	0.12	0.08	0.15
Grit-Consistency	0.04	0.10	0.07	0.03	0.10	0.05
Grit-Perseverance	0.12	0.12	0.23	0.14	0.12	0.27
Technical Competence	0.12	0.08	0.19	0.00	0.11	0.00
Gender				-0.10	0.09	-0.13
R^2	0.10			0.13		

Notes. *B* = unstandardized coefficient, SE = standard error, β = standardized coefficient, R^2 = Level 1 variance explained by predictors.
*p<.05.

Personality as Assessed by the Big Five

According to Credé and colleagues (2016), it has been argued that the predictive validity for grit on desired outcomes (i.e., academic and non-academic performance) is null, after accounting for conscientiousness. In order to test whether this notion holds true for leadership, I conducted a series of model comparison tests whereby leader emergence was regressed onto grit, after controlling for conscientiousness. These results are depicted in Tables 27 and 28, and support the indication that grit-perseverance provides incremental validity above and beyond conscientiousness when explaining leader emergence in Sample 2. Specifically, there was a

positive and significant effect of grit-perseverance on lagged leader emergence after accounting for conscientiousness ($B = 0.64$, $p<.05$).

In addition to leader emergence, I also tested whether grit holds predictive validity on leadership effectiveness, after controlling for conscientiousness. Results are depicted in Tables 29-32, and provide support that grit-perseverance is a significant contributor to leadership effectiveness. Specifically, grit-perseverance significantly predicted initial leadership effectiveness in Sample 2 ($B= 0.55$, $p<.05$), after accounting for conscientiousness and this effect approached significance in Sample 1 ($B= 0.92$, $p=.07$). In regards to lagged leadership effectiveness, the effect of grit-perseverance after controlling for conscientiousness approached significance ($B = 0.48$, $p = 0.08$) in Sample 2 and Sample 1 ($B = 1.12$, $p = 0.09$).

Table 27
Summary of Regression Analysis for Model Where Lagged Leader Emergence is Regressed onto Grit, While Controlling for Conscientiousness: Sample 1

	Model 1			Model 2		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Intercept	0.00	0.11	0.00	0.00	0.11	*0.00*
Assertiveness				0.31	0.37	0.38
Grit-Consistency				-0.68	0.66	-0.55
Grit-Perseverance				0.94	0.51	0.78
Technical Competence				-0.26	0.21	-0.35
Conscientiousness	0.57*	0.22	0.59*	0.42	0.25	0.44
R^2	0.37			0.50		

Notes. *B* = unstandardized coefficient, SE = standard error, *β* = standardized coefficient, R^2 = Level 1 variance explained by predictors.
*$p<.05$.

Table 28

Summary of Regression Analysis for Model Where Lagged Leader Emergence is Regressed onto Grit, While Controlling for Conscientiousness: Sample 2

	Model 1			Model 2		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Intercept	-0.01	0.09	0.00	0.00	0.09	*0.00*
Assertiveness				0.04	0.24	0.03
Grit-Consistency				-0.29	0.20	-0.26
Grit-Perseverance				0.64*	0.26	0.66*
Technical Competence				0.15	0.17	0.13
Conscientiousness	0.58*	0.17	0.60*	0.34	0.21	0.33
R^2	0.19			0.30		

Notes. *B* = unstandardized coefficient, SE = standard error, *β* = standardized coefficient, R^2 = Level 1 variance explained by predictors.
*p<.05.

Table 29

Summary of Regression Analysis for Model Where Initial Leadership effectiveness is Regressed onto Grit, While Controlling for Conscientiousness: Sample 1

	Model 1			Model 2		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Intercept	0.00	0.11	0.00	0.00	0.08	*0.00*
Assertiveness				0.72	0.29	0.69
Grit-Consistency				-0.83	0.53	-0.52
Grit-Perseverance				0.92†	0.41	0.60†
Technical Competence				-0.27	0.17	-0.29
Conscientiousness	0.76*	0.21	0.79*	0.64*	0.20	0.52*
R^2	0.51			0.72		

Notes. *B* = unstandardized coefficient, SE = standard error, *β* = standardized coefficient, R^2 = Level 1 variance explained by predictors.
*p<.05, $^{\dagger}p$<.10.

Table 30

Summary of Regression Analysis for Model Where Initial Leadership effectiveness is Regressed onto Grit, While Controlling for Conscientiousness: Sample 2

	Model 1			Model 2		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Intercept	0.00	0.08	0.00	0.00	0.08	*0.00*
Assertiveness				0.04	0.20	0.03
Grit-Consistency				-0.14	0.17	-0.14
Grit-Perseverance				0.55*	0.23	0.64*
Technical Competence				0.16	0.15	0.16
Conscientiousness	0.50*	0.15	0.52*	0.24	0.18	0.26
R^2	0.19			0.31		

Notes. *B* = unstandardized coefficient, SE = standard error, *β* = standardized coefficient, R^2 = Level 1 variance explained by predictors. *p<.05.

Table 31

Summary of Regression Analysis for Model Where Lagged Leadership effectiveness is Regressed onto Grit, While Controlling for Conscientiousness: Sample 1

	Model 1			Model 2		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Intercept	0.00	0.12	0.00	0.00	0.11	*0.00*
Assertiveness				0.43	0.39	0.44
Grit-Consistency				-0.85	0.71	-0.57
Grit-Perseverance				1.12†	0.55	0.77†
Technical Competence				-0.20	0.22	-0.23
Conscientiousness	0.81*	0.24	0.84*	0.59†	0.27	0.51†
R^2	0.50			0.59		

Notes. *B* = unstandardized coefficient, SE = standard error, *β* = standardized coefficient, R^2 = Level 1 variance explained by predictors.

*$p<.05$, †$p<.10$.

Table 32

Summary of Regression Analysis for Model Where Lagged Leadership effectiveness is Regressed onto Grit, While Controlling for Conscientiousness: Sample 2

	Model 1			Model 2		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Intercept	0.00	0.09	0.00	0.00	0.09	*0.00*
Assertiveness				-0.01	0.24	-0.01
Grit-Consistency				-0.16	0.21	-0.15
Grit-Perseverance				0.48†	0.27	0.52†
Technical Competence				0.07	0.18	0.06
Conscientiousness	0.48*	0.17	0.50*	0.30	0.22	0.30
R^2	0.15			0.20		

Notes. *B* = unstandardized coefficient, SE = standard error, *β* = standardized coefficient, R^2 = Level 1 variance explained by predictors.

*$p<.05$., †$p<.10$.

Gender

The effect of gender on leadership criteria was also investigated within the current context. Specifically, I attempted to discern whether gender predicted leader emergence, effectiveness, and likeability as previous research has indicated this demographic characteristic plays a role in determining leadership across settings and criteria (e.g., Eagly & Karau, 1991). On the contrary, I anticipated gender to not be a significant predictor of leader emergence, effectiveness, and likeability in this context because team leaders are not formally appointed, rather they are determined based on perceptions of team members. Furthermore, research suggests leader emergence within self-managed teams occurs based on team needs and goals (e.g., Bergman et al., 2014), as opposed to gender or other demographic characteristics. The current results provide initial evidence to this as gender was not a significant predictor of leader emergence, effectiveness, or likeability across time and samples. Results are depicted in Tables 19-26 and 33-36.

Table 33
Summary of Regression Analysis for Model Where Initial Leader Emergence is Regressed onto Gender, While Controlling for Additional Independent Variables: Sample 1

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Intercept	0.00	0.10	0.00	-0.01	0.39	0.00
Assertiveness	0.62	0.34	0.86	0.63	0.37	0.87
Grit-Consistency	-1.15	0.60	-1.05	-1.15	0.64	-1.05
Grit-Perseverance	1.25*	0.43	1.17*	1.25*	0.47	1.17*
Technical Competence	-0.23	0.19	-0.35	-0.23	0.20	-0.35
Gender				0.01	0.32	0.01
R^2	0.42			0.39		

Notes. *B* = unstandardized coefficient, SE = standard error, β = standardized coefficient, R^2 = Level 1 variance explained by predictors.
*p<.05.

Table 34

Summary of Regression Analysis for Model Where Initial Leader Emergence is Regressed onto Gender, While Controlling for Additional Independent Variables: Sample 2

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Intercept	-0.00	0.09	0.00	-0.24	0.28	0.00
Assertiveness	0.22	0.22	0.15	0.22	0.23	0.15
Grit-Consistency	-0.15	0.20	-0.14	-0.15	0.20	-0.14
Grit-Perseverance	0.74*	0.24	0.79*	0.74*	0.25	0.79*
Technical Competence	0.14	0.17	0.12	0.14	0.17	0.12
Gender				0.02	0.19	0.01
R^2	0.28			0.27		

Notes. *B* = unstandardized coefficient, SE = standard error, β = standardized coefficient, R^2 = Level 1 variance explained by predictors.
*p<.05.

Table 35

Summary of Regression Analysis for Model Where Lagged Leader Emergence is Regressed onto Gender, While Controlling for Additional Independent Variables: Sample 1

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Intercept	0.00	0.12	0.00	-0.08	0.45	0.00
Assertiveness	0.39	0.40	0.48	0.40	0.44	0.49
Grit-Consistency	-0.96	0.71	-0.78	-0.97	0.75	-0.79
Grit-Perseverance	1.32*	0.51	1.10*	1.31†	0.55	1.09†
Technical Competence	-0.18	0.22	-0.24	-0.19	0.24	-0.26
Gender				0.07	0.38	0.05
R^2	0.38			0.35		

Notes. *B* = unstandardized coefficient, SE = standard error, β = standardized coefficient, R^2 = Level 1 variance explained by predictors.
*p<.05, $^{\dagger}p$<.10.

Table 36

Summary of Regression Analysis for Model Where Lagged Leader Emergence is Regressed onto Gender, While Controlling for Additional Independent Variables: Sample 2

	Model 1			Model 2		
Variable	*B*	*SE B*	β	*B*	*SE B*	β
Intercept	-0.00	0.09	0.00	-0.17	0.28	0.00
Assertiveness	0.16	0.23	0.11	0.14	0.23	0.09
Grit-Consistency	-0.23	0.20	-0.20	-0.23	0.21	-0.20
Grit-Perseverance	0.80*	0.25	0.82*	0.78*	0.25	0.80*
Technical Competence	0.15	0.18	0.13	0.15	0.18	0.13
Gender				0.12	0.19	0.08
R^2	0.27			0.27		

Notes. *B* = unstandardized coefficient, SE = standard error, β = standardized coefficient, R^2 = Level 1 variance explained by predictors. *p<.05.

CHAPTER SIX: Discussion

For over a decade, the use of self-managed work teams has steadily increased across industries (Lawler, 1998; Wolff, Pescosolido, & Druskat, 2002), leading to a greater need for an understanding regarding the underlying mechanisms of this team structure (Cohen & Bailey, 1997; Nygren & Levine, 1996). In opposition to more traditional teams, there is no formally designated leader on a self-managed team, rather those individuals that influence and guide the team to goal attainment do so because they are chosen by the other team members. This process is referred to as leader emergence, and it unfolds in accordance with implicit leadership theory (e.g., Epitropaki, & Martin, 2004); individuals are perceived to exert influence and be leader-like because they exhibit qualities and behaviors indicative of a leader as perceived by others. The current effort seeks to identify how the process of leader emergence evolves over time within self-managed teams in order to provide scientists and practitioners with a greater understanding of who will emerge as a leader and when. Who emerges as a leader is important to consider as this individual, or set of individuals, directly influences team goal achievement, team processing, and performance (Luft, 1984; Neubert, 1999; Neubert, & Taggar, 2004; Schneider & Goktepe, 1983). According to DeSouza and Klein (1995), emergent leaders' personal goals strongly inform the team's goal(s) choice. Further, they are responsible for providing the team with direction, certainty, and a plan of action under ambiguous circumstances or during setbacks (Pescosolido, 2002). In other words, although emergent leaders are not formally appointed a leadership role, they engage in leadership behaviors thereby having a direct effect on team performance and exert significant influence on other team members (Schneider & Goktepe, 1983; Serban et al., 2015). For these reasons, it is necessary to comprehend who emerges as a leader over time, why, and whether they stay in-role or alternate over time.

At present, we are fairly confident about several factors in relation to leader emergence. For example, there is large body of work linking intelligence, extraversion, and genetic factors to leader emergence (e.g., Arvey et al., 2006; Ensari et al., 2011). We also know that social- and self-categorization play a role in determining who emerges as a leader (Toh & Leonardelli, 2013). That is, it is necessary for others to perceive an individual as a leader and for this individual to regard themselves as a leader in order for them to exert influence over others. Because the process of leader emergence is perception-based, research also suggests it lends itself to gender disparities. According to gender role theory, men are perceived to exert qualities and behaviors that align more with leader prototypes as compared to women; because of this, they are more likely to exhibit greater levels of leader emergence (Eagly & Karau, 1991). Despite these understandings, however, questions remain regarding leader emergence because of the methodologies implemented in previous empirical work (e.g., most are cross-sectional and implement laboratory experimental designs). As such, researchers have called for more longitudinal research (e.g., Kalish and Lurua, 2016) to fully ascertain the underpinnings of leader emergence, specifically in regards to examining the process over time. Relatedly, research conducted in the field and using samples generalizable to the organizational context is needed to supplement the large body of work that has been conducted in the laboratory (e.g., leaderless group discussions; Campbell, Simpson, Stewart, & Manning, 2003). In response, the current study employs a longitudinal, quasi-experimental study design using to address the following research questions: *Does an individual's level of leader emergence change over time? Does a certain pattern of individual difference characteristics explain leader emergence?*

Results suggest that an individual's level of leader emergence within the current context remains stable throughout the team's life cycle; however, the predictors associated with this

variable change over time. Specifically, assertiveness and grit were found to predict initial leader emergence, while only grit predicted lagged leader emergence. Moreover grit, a deep-level leadership characteristic was found to be associated with leader emergence and effectiveness across time and samples, providing support for this facet-level personality trait as an indicator of leadership. These findings are discussed and expanded upon below along with additional conclusions drawn from the current effort.

Leader Emergence Over Time

As part of the proposed model, I hypothesized that team members would experience a change in their level of leader emergence from time point A (i.e., initial leader emergence) to time point B (i.e., lagged leader emergence). The findings were contrary to this hypothesis such that relative levels of leader emergence were stable over time. In support of the proposed model, however, results suggested that criteria utilized to perceive leader emergence changes over time. Specifically, it was hypothesized that surface-level leader traits (i.e., assertiveness) would predict initial leader emergence, while deep-level leader traits (i.e., grit, technical competence) would predict lagged leader emergence. In partial support of this, I found that surface- and deep-level leader traits predicted initial leader emergence and only deep-level leader traits predicted lagged leader emergence.

The lack of change in leader emergence within this context can be partially explained by the degree of familiarity between team members in both samples. Although Sample 1 was intended to represent ad-hoc teams (meaning team members are unfamiliar with one another and have not worked together in the past), the average level of team member familiarity was 3.38 (on a 5-point Likert scale). Similarly, the average level of team member familiarity in Sample 2 was 4.00 (on a 5-point Likert scale). Because team members were familiar with one another at the

beginning of the study, their ability to identify deep-level leader traits was enhanced because team members possessed shared experiences and repeated interactions. According to Barrick and colleagues (2000), observers are unable to detect covert personality traits during initial interactions, but over time they develop the ability to do so. As such, because team members displayed some degree of familiarity with one another, they were able to utilize deep-level leader traits in addition to surface-level leader traits to form evaluations in regards to initial leader emergence. This notion is reinforced by the finding that assertiveness (i.e., a surface-level leader trait) exhibited predictive validity at Time 1, but not at Time 2. Further, the relationship between assertiveness and initial leader emergence diminished when the model accounted for grit-perseverance. As such, for initial leader emergence, familiar team members possessed the ability to deduce deep-level leader traits as well as surface-level leader traits. Over time, the utility of assertiveness waned as this variable was not significantly related to lagged leader emergence when isolated[5], or when included in the full model containing deep-level leader traits as predictors. For the latter model, grit-perseverance significantly predicted lagged leader emergence. Similar results were found in Kalish and Luria's (2016) study on dynamic leader emergence within short-lived teams. In particular, they also identified a strong relationship between Time 1 and Time 2 leader emergence ($r = .76, p < .01$), but concluded that the criteria utilized to determine others' leader emergence ratings differed over time. The current study expands upon this and provides evidence for the notion of surface- and deep-level leader traits as predictors of leader emergence over time in long-duration teams.

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[5] In order to see if the findings were similar across time points, I regressed lagged leader emergence onto assertiveness. Findings were non-significant for both Sample 1 ($B = -0.05, t(9)=-0.21, p>.05$) and Sample 2 ($B = 0.45, t(38)=1.90, p>.05$).

Individual Difference Characteristics as Predictors of Leader Emergence

Parallel to previous research and theory (e.g., Eagly et al., 2000), I found assertiveness to predict leader emergence; however, this was only a significant predictor for initial leader emergence when isolated. As noted above, when deep-level leader traits (i.e., grit, technical competence) where included in the model, the predictive validity of assertiveness on initial leader emergence diminished. This finding provides incremental understanding regarding the process of leader emergence within self-managed teams by suggesting that the relationship between assertiveness and initial leader emergence might be more complex than originally concluded. Previous research indicates that assertive, dominant, and extraverted team members exhibit greater levels of leader emergence than those who are diffident (e.g., Hegstrom & Griffith, 1992; Rueb, Erskine, & Foti, 2008). Although informative, a significant portion of this research was conducted utilizing teams who worked together for a short period of time. The current results suggest that the relationship between assertiveness and leader emergence may be more complex for teams that are familiar with one another and who work together for a longer duration of time. In this setting, it could be the case that an individual's level of grit-perseverance explains the relationship between assertiveness and initial leader emergence. During team inception, it is often the case that team members are immersed in the transition process of teamwork (Mathieu, Marks, & Zaccarro, 2001). That is, team members are formulating plans for task execution and goal attainment, identifying team goals, relaying roles and responsibilities, and engaging in other processes related to mission analysis and planning. In order for an individual to be perceived as a leader by others throughout this process (i.e., demonstrate emergent leadership), it is possible that not only do they have to be decisive, confident, and forceful (i.e., exhibit assertiveness), but also have to be purposeful, determined, and tenacious

(i.e., manifest grit-perseverance). Further, it is through an individual's actions of perseverance that they are able to initially hold influence over others and demonstrate leadership behaviors because this perseverance establishes a sense of trust among team members in regards to their leadership capabilities. The establishment of trust in another team member is an essential element to leader emergence (Marinova et al., 2013), and according to Rempel and colleagues (1985) relational trust develops when an individual exhibits dependability and goodwill. As such, assertive team members are regarded as leaders through their perseverance, which leads to an establishment of trust and ultimately leadership. Although this study provides initial evidence for this, future research should further examine whether grit-perseverance mediates the relationship between assertiveness and initial leader emergence.

Different results were found for lagged leader emergence; grit-perseverance was the only significant predictor. Assertiveness did not demonstrate predictive validity on lagged leader emergence when isolated or when grit and technical competence were included in the model. Based on this, it can be concluded that over time grit-perseverance, a deep-level leader trait, becomes the main contributor to an individual's perceived level of leader emergence as indicated by other team members. For instance, for every one unit increase in a team member's relative level of grit-perseverance, their relative level of leader emergence (as indicated by others) can increase by as much as 1.32. Results also suggested that grit-perseverance was a significant predictor of leadership effectiveness as indicated by other team members. On average, it was

found that for every one unit increase in a team member's relative level of grit-perseverance, their relative level of leadership effectiveness (as indicated by others) increased by 1.11[6] units.

These findings are noteworthy as they provide evidence that grit-perseverance is a significant contributor to leadership; furthermore, the current results provide us with a greater understanding of the concept of grit and its utility. Despite the large body of research documenting the predictive validity of grit on academic and non-academic performance (e.g., Arouty, 2015; Chang, 2014; Kelly, Matthews, & Bartone, 2014; Duckworth, Kirby, Tsukayama, Berstein, & Ericsson, 2011; Eskreis-Winkler, Shulman, & Duckworth, 2014), recent meta-analytic evidence by Credé and colleagues (2016) suggested that the incremental validity of grit above and beyond conscientiousness (its higher-order personality factor) might be nonexistent. This study provides evidence that grit-perseverance is a powerful predictor of leadership, above and beyond conscientiousness. Within self-managed teams, individuals who are persistent, determined, and resilient influence others and contribute much to the team's goals and overall direction. Furthermore, these individuals are also perceived by other team members to be effective team leaders. These findings are consistent across team, sample, and time providing evidence that the power of grit-perseverance on leadership criteria is impressive and more than what was initially expected. In their meta-analytic investigation, Credé and colleagues (2016) also argued for grit to be measured as a multidimensional construct, consisting of two factors (i.e., consistency and perseverance), rather than a unidimensional construct, which is typically how grit is assessed. The current study employed this measurement technique and found support for this notion. Only grit-perseverance was significantly related to leadership; non-significant

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[6] This value was calculated by averaging across the four significant *B* (unstandardized) values associated with grit-perseverance from each model wherein leadership effectiveness was regressed onto grit-perseverance and the additional independent variables.

findings were evidenced for grit-consistency, further bolstering the argument that grit is comprised of two factors which demonstrate opposing patterns of predictive validity. In sum, within the context of leadership, grit-perseverance is a valid predictor; however, grit-consistency is not.

The current results also provide evidence in support of measuring personality at the facet-level, rather than the higher-order level, when examining leadership criteria. In 1999, Taggar, Hackew, and Saha noted that lower-level personality traits (e.g., assertiveness, grit) might demonstrate a greater level of explanatory power on leadership criteria as compared to traits measured at the higher-order factor level (i.e., extraversion, conscientiousness). The primary independent variables included in the current empirical investigation reflected those measured at the facet-level. Consequently, the results discussed above provide initial evidence in support of Taggar et al.'s (1999) argument. Relatedly, the strong relationship between grit-perseverance, leader emergence, and leadership effectiveness also provides an explanation to the inconsistent findings regarding conscientiousness and leadership criteria. Although some researchers have reported a significantly positive relationship between conscientiousness and leadership (Ensari, Riggio, Christian, & Carslaw, 2011), others have indicated that this construct might be negatively or unrelated to leadership (e.g., Deuling, Denissen, van Zalk, Meeus, & van Aken, 2011). Because grit-perseverance is a facet of conscientiousness, the current results demonstrate that contradictory results can potentially be explained by the methodological design implemented. It is likely the case that other facets of conscientiousness (e.g., orderliness), do not positively predict leader emergence and effectiveness. As such, when measured at the higher-order level, the relationship becomes confounded producing inaccurate and inconsistent results.

Practical Implications

In addition to the theoretical and scientific contributions noted above, the current effort also provides a number of practical implications. First, the current effort provides support for the consideration of both surface- and deep-level leader traits when identifying, hiring, and training leaders. According to implicit leadership theory, individuals are perceived to be leader like if they demonstrate characteristics indicative of a stereotypical leader. In line with this, I found that assertiveness (an agentic quality that is a facet of extraversion, which is typically associated with leadership; Judge et al., 2002; McCrae & Costa, 1997), was related to initial leader emergence. However, over time this predictive validity diminished and team members displaying more grit-perseverance (a deep-level leader trait that is not typically considered to be a leader-like quality) were regarded as emergent and effective leaders. Based on this, it is recommended that practitioners also include deep-level leader traits, such as grit-perseverance, when selecting for leadership roles.

As previously indicated, there is a lack of female leaders within the current workforce with only 5.2% of Fortune 500 companies holding a female Chief Executive Officer (Pew Research Center Social and Demographic Trends, 2015). The failure to vertically promote women within organizations poses a societal and economical issue (McKinsey Global Institute, 2015). Equal opportunity and a representative workforce are critical in order to advance society and promote business growth and innovation. Evidence suggests that women adopt leadership practices that are complementary to complex and innovative situations (Eagly & Carli, 2003; Eagly, Gartzia, & Carli, 2014); furthermore, the failure to incorporate the entire talent pool when hiring or promoting individuals results in the underutilization of women in the workforce. Women offer unique business perspectives and tend to prioritize projects that lead to an increase

in social outcomes and increased ethical liability (Eagly, Gartzia, & Carli, 2014). As such, in order for organizations to reach their maximum potential, it is important that female leaders are instated; furthermore, researchers have recently called for strategies to improve the gender leadership disparity (Elprana, Felfe, Stiehl, & Gatzka, 2015).

The current study provides a potential solution to this issue; the implementation of self-managed work teams. Previous work has indicated that men are more likely to emerge as leaders within the organizational, political, and research domain (Berdhal, 1996), and this tendency enhances as the level of organizational hierarchy increases (Barling, 2014). Interestingly, the current results are in opposition to this finding as there was not a significant gender difference between leader emergence, effectiveness, or likeability. Leaders on self-managed teams are not formally designated; rather, they are identified based on other team members' perceptions of leader-like behaviors (Hollenbeck et al., 2012). As such, because team members hold shared goals and responsibilities as a team, they might be more inclined to select and be influenced by individuals possessing qualities that are reflective of effective leadership and related to the task at hand, rather than exhibiting a bias associated with typical gender roles (e.g., Bergman et al., 2014). Current findings provide initial support for this notion; consequently, organizations may want to employ self-managed teams as a way to foster leader gender equality in the workplace. According to King, Botsford, Hebl, Kazama, Dawson, and Perkins (2012), women are disadvantaged when in the running for formally appointed, high-level leadership roles because they do not receive comparable developmental experiences than that of their male counterparts. The use of self-managed work teams may mitigate this by providing women with organic leadership experiences and challenging work.

Limitations and Future Research

Although the current study offers several noteworthy contributions, it is not without limitations. For instance, the level of familiarity between team members was high, despite teams from Sample 1 being ad-hoc. Because of this, the importance of deep-level leader traits on initial leader emergence might reflect an over-estimate than what is typical of ad-hoc teams. Parallel to theory regarding overt versus covert personality traits (Barrick et al., 2000; Funder, 1995), I argue that deep-level leader traits are harder to evaluate upon initial interactions; as such, more research is needed using a sample displaying lower levels of initial familiarity to fully understand the relationships between leader emergence and surface- versus deep-level leader traits. Although this is a limitation of the current effort, because team members were familiar with one another the results might be more generalizable to organizations using self-managed teams. It is likely the case that employees of the same organization are familiar with one another, yet have not worked together on a self-managed team, mirroring the current sample. Despite this, however, researchers need to conduct similar hypothesis tests utilizing teams that have no prior knowledge of other team members to test the dynamic model of leader emergence in its entirety.

In regards to technical competence, the current results indicate a non-significant relationship between this deep-level leader trait and leader emergence and effectiveness. This finding is in contrast to previous research and theory; moreover, it is important to identify several limitations to the current study that might make this finding inconclusive. In particular, the current sample demonstrated a relatively high level of technical competence (Sample 1: M = 2.62, SD = 0.72; Sample 2: M = 3.40; SD = 0.62). Relatedly, because participants in the current sample share similar experiences and are at the same educational level, it is likely the case that a lack of variance in technical competence was present among Sample 1 and Sample 2. The

technical competence measure utilized in this study also demonstrated a low level of internal consistency across samples, further bolstering the argument that the current results regarding this construct should be interpreted with caution. Future research is needed to further investigate the relationship between technical competence and leader emergence over time.

Although assertiveness was found to be a significant predictor of initial leader emergence, evidence suggests that this relationship might not be stable across teams (see Figures 7 and 8). Specifically, it seems that there might be a negative relationship between this surface-level leader trait and initial leader emergence in Teams 3 and 5 in Sample 2 and Team 3 in Sample 1, suggesting that the relationship between assertiveness and initial leader emergence might be more complicated than originally concluded. For example, it could be the case that the team's composition of personality traits or other characteristics interacts with this relationship, leading to some teams experiencing a positive relationship, while others a negative relationship. More research on team composition and its influence on leadership criteria is needed in order to fully discern this relationship.

Future research should also investigate whether predictors of leader emergence and effectiveness within self-managed teams vary across cultures. According to research by Turetgen, Unsal, and Erdem (2008), predictors of leader emergence differ by culture, such that traits typically indicative of a leader in Western cultures are not necessarily predictive of leader emergence in other cultures. For instance, they did not find a significant relationship between self-efficacy and leader emergence as well as dominance and leader emergence in Turkish sample. As such, it could be the case that grit-perseverance or assertiveness does not hold predictive validity over leadership criteria in non-Western cultures. Because the current study

was unable to account for this, more research is needed to ascertain whether these leader traits are indicative of leadership in self-managed teams across cultures.

Conclusion

By leveraging unconventional leadership structures, self-managed teams have the capacity to increase creativity, performance, innovation, diversity, and other desirable outcomes. Because of this, the use of self-managed teams within organizations continues to rise. It is important for researchers to parallel this trend and conduct longitudinal research on samples generalizable to the organizational environment in order to fully understand the underlying mechanisms of self-managed teams. In particular, it is important to discern who emerges as a leader within this context as this individual, or set of individuals, will hold continued influence over the team (Serban et al., 2015). To address this, the current effort consisted of a longitudinal, quasi-experimental study with engineering product development teams. The predictive validity of both surface- and deep-level leader traits was tested over time, and results suggested that the criteria utilized to discern leader emergence may change throughout the team's life cycle.

In sum, the current effort provides several notable outcomes. First, leader emergence was found to be stable over time within the current context. Secondly, the relationship between assertiveness and initial leader emergence within familiar, self-managed teams might be more complex than originally deduced. Results suggest that the predictive validity of this surface-level leader trait on initial leader emergence did not explain incremental variance above and beyond grit-perseverance (arguably a deep-level leader trait). Thirdly, grit-perseverance was found to be the only significant predictor of lagged leader emergence, and this relationship was significant after accounting for assertiveness, technical competence, and personality as measured by the Five Factor model. Additionally, grit-perseverance predicted leadership effectiveness over time,

indicating that this deep-level leader trait is an important indicator of leadership. Lastly, a supplemental analysis revealed gender to not have a significant effect on leadership criteria, providing initial evidence that this leadership structure might pose as a strategy for reducing gender leadership disparity in organizations. Taking these outcomes into account, it is concluded that within familiar, self-managed teams an individual's level of leader emergence, and therefore influence over the team, remains stable. However, the individual difference characteristics used to evaluate leader emergence may change over time as surface- and deep-level leader traits seem to influence initial leader emergence and only deep-level leader traits affect lagged leader emergence. These findings advance current leadership and personality research as they highlight the benefit to measuring personality at the facet-level when predicting leadership, provide evidence that grit matters for leadership, above and beyond conscientiousness, and suggest that both surface- and deep-level leader traits should be considered when evaluating leadership.

APPENDIX A: Dictionaries Used for the Pilot Study

Grit

accomplish	do	gusto	momentum
achieve	doggedness	guts	motivated
achievement	don't give up	gutsy	motivation
adherence	dream	hang on	moxie
almost there	drive	hardiness	muster
ambition	driven	has to be another approach	never back down
ardor	effort	has to be another method	never give up
audacious	embark	has to be another way	on track
audacity	endurance	headway	opportunity
backbone	endure	hold on	other approaches
bear it	engaged	hope	other avenues
boldness	enthusiasm	hopeful	other ideas
brave	exceed	idea	other methods
bravery	excel	implacable	outdo
can't back down	execute	indefatigable	overcome
can't give up	fearless	indomitable	passion
challenge	fervor	industrious	patience
charge	fierce	intense	patient
chase	fight	intensity	persevere
commitment	figure it out	interest	persist
competitor	figure out	intrepid	Persistence
complete	find solution	invest	pioneer
concentrate	finish	invested	pluckiness
consistent	firm	irrepressible	possibilities
conviction	fix	just do it	possibility
courage	fixate	keep going	power through
courageous	fixed	keep thinking	press on
daring	focus	keep trying	problem solve
dauntless	focused	kick ideas around	progress
dedicated	fortitude	let's hear more	progression
dedication	fulfill	let's not give up	purpose
desire	give it a try	let's try more	pursue
determination	go on	lifework	pursuit
develop	go the distance	long-lasting	rally
development	goal	longstanding	readjust
diligence	growth	look forward	reassess
diligent	gumption	mission	redo
redraw	tireless	change	remember

Grit

reevaluate	tolerance	conclude	remnant
reexamine	tolerate	constant	resolve
reform	toss ideas around	continue	review
reformulate	troubleshoot	cook up	rigid
reframe	try to find	course	risk
regroup	tweak	decision	rival
relentless	undertake	definite	robust
remain	undertaking	determine	rooted
repeat	undeterred	different idea	route
resilient	unrelenting	durable	sharpen
resolute	unremitting	duty	sit tight
responsibility	unshakeable	everything	solid
rethink	unwavering	evolve	spitball
revamp	unyielding	experiment	spunk
revise	vigor	formulate	spunky
rework	vigorous	hold	stick
solve	we can do this	home in	still
something that works	we just have to	improvement	sweat
spirit	we've got this	in a new light	tactic
stalwart	what it takes	intent	task
stamina	willpower	just yet	temporary
stay	withstand	method	think back
staying power	worth it	mettle	thought
steadfast	you can do it	more	through
steady	you've got this	nerve	throwing it out there
steeled	zeal	new idea	tough
stride	zealous	nonetheless	trial
strive	adjust	objective	try
stubborn	adversity	perfect (v)	visualize
stubbornness	again	perfecting	wait
succeed	another	plan	war
success	approach	pluck	way
surpass	best	pros	we will
survivor	bide	pull	what else
sustain	brainstorm	push	yet
target	brainstorming	rack brains	
tenacity	brawny	real	
test	calling	rehash	

Assertiveness

absolutely	decisive	I can do it	my assignment
absolutely not	defend	I can do this	my design
action	demanding	I disagree	my expectation is
advantage	determined	I do mind	my goal
affirm	direct	I expect	my idea
agency	directive	I have to	my opinion is
ambition	do it again	I insist	my perspective
ambitious	do less	I know	my piece
argue	do this	I need	my plan
ask	dogmatic	I prefer	my project
assured	dominance	I propose	my question is
autonomy	dominant	I say	my section
benefit	draw it again	I see it	my solution
bold	emphatic	I want	my task
build	erase that	I would say	my thoughts are
can you	erase this	I'll tell you	my view is
can you not	exert	I'm going to	my vote is
candid	explain	I've got to	my way
capitalize	express	impel	no let's
capture	figure it out	imperative	no offense
certain	focus on me	insist	no we
champion	forceful	insistent	no you
change that	forthright	keep tabs	not now
change this	forward	leave it	oversee
charge	get down to brass tacks	let me say	pay attention
check mine	get going	let me tell you	personally
chief	get me	let's get real	persuasive
communicate	hammer out	let's go	prerogative
compel	handle	let’s try mine	put forward
competitive	here's the deal	listen here	run it again
concentrate on me	here's the plan	listen to me	say something
confidence	here's the thing	listen up	seize
confident	here's what I think	look at it	self-assured
constructive	here's what I want to say	look at mine	self-esteem
control	here's what I'm thinking	mine	self-expression
critical	honestly	move that	speak my mind
cut to the chase	how I see it	move this	speak out

Assertiveness

speak up	bargain	incorporate	priority
speaking my mind	better	indispensable	proactive
stand up	bring	intend	purpose
step in	call	is	put
step up	catch up	its because	reach
stick up	central	lawsuit	read
strong	client	leave	reap
strong-willed	compare	let me ask	recognize
supervise	compelling	look	remember
thank you but	confer	main	remove
thanks but	connect	maintain	respond
that looks bad	conscious	make	results
that looks good	contend	maneuver	see if
that's terrible	contract	me	self-efficacy
think big	contrast	move	send
this will work	cover	must	serious
this won't work	crucial	my	shh
try again	deal	necessary	should
try it again	deliberate	need	show
urge	democratic	network	significant
voice	design	never	sit
we have to	earn	nitty-gritty	solution
we need to	egalitarian	no	status
we should	essentially	note	strategic
we've got to	essential	now	sue
why can't you	extraverted	open	sure
why did you do that	find	outgoing	take
you go	follow up	own	talk
you have to	foremost	paramount	tell
you need to	get	pass	terms
you should	grab	perform	text
you understand	gravity	pick up	that is
you've got to	guide	pivotal	time
account	help	power	tough
act	I	present	uphold
add more	I'm not	pressing	urgent
aggression	I've been	primary	use
aggressive	important	prime	utilize

Assertiveness

aim	improve it	principal	valuable
vehement	vital	want	write

APPENDIX B: Technical Competence Measure Used for the Pilot Study

Skills Inventory: Level of Technical Competence

	Experience (Please Circle)		
Prototyping	None	Some	Extensive
Drawing/Sketching	None	Some	Extensive
Laser Cutter	None	Some	Extensive
Plasma Cutter	None	Some	Extensive
Sending/Painting/Finishing	None	Some	Extensive
Computer Aided Design	None	Some	Extensive
CNC Machining	None	Some	Extensive
3D Printing	None	Some	Extensive
Molding	None	Some	Extensive
Mill/Lathe	None	Some	Extensive
Power Tools	None	Some	Extensive
Electronics	None	Some	Extensive

APPENDIX C: Measures Used for the Main Study

Grit

Duckworth, A.L., Peterson, C., Matthews, M.D., & Kelly, D.R. (2007). Grit: Perseverance and passion for long-term goals. Journal of Personality and Social Psychology, 9, 1087-1101.

Items:

Please use the rating scale below to describe how accurately each behavioral statement describes you. Describe yourself as you generally are now, not as you wish to be in the future.

Consistency of Interests

1. I often set a goal but later choose to pursue a different one. (Reverse code)
2. New ideas and new projects sometimes distract me from previous ones. (Reverse code)
3. I become interested in new pursuits every few months. (Reverse code)
4. My interests change from year to year. (Reverse code)
5. I have been obsessed with a certain idea or project for a short time but later lost interest. (Reverse code)
6. I have difficulty maintaining my focus on projects that take more than a few months to complete. (Reverse code)

Perseverance of Effort

7. I have achieved a goal that took years of work.
8. I have overcome setbacks to conquer an important challenge.
9. I finish whatever I begin.
10. Setbacks don't discourage me.
11. I am a hard worker.
12. I am diligent.

Scale:

5 = Very much like me
4 = Mostly like me
3 = Somewhat like me
2 = Not much like me
1 = Not like me at all

Assertiveness

McCormick, I.A. (1984). A simple version of the Rathus Assertiveness Schedule. Behavioral Assessment, 7, 95-99.

Items:

Please use the rating scale below to describe how accurately each behavioral statement describes you. Describe yourself as you generally are now, not as you wish to be in the future.

1. Most people stand up for themselves more than I do. (Reverse code)
2. At times I have not made or gone on dates before because of my shyness. (Reverse code)
3. When I am eating out and the food I am served is not cooked the way I like it, I complain to the person serving it.
4. If a person serving in a store has gone to a lot of trouble to show me something, which I do not really like, I have a hard time saying "No". (Reverse code)
5. There are times when I look for a good strong argument.
6. I try as hard to get ahead in life as most people like me do.
7. To be honest, people often get the better of me. (Reverse code)
8. I do not like making phone calls to businesses or companies. (Reverse code)
9. I feel silly if I return things I don't like to the store that I bought them from. (Reverse code)
10. If a close relative that I liked were upsetting me, I would hide my feelings rather than say I was upset. (Reverse code)
11. I have sometimes not asked questions for fear of sounding stupid. (Reverse code)
12. During an argument I am sometimes afraid that I will get so upset that I will shake all over. (Reverse code)
13. If a famous person was talking in a crowd and I thought he or she was wrong, I would get up and say what I thought.
14. If someone has been telling false and bad stories about me, I see him (her) as soon as possible to "have a talk" about it.
15. I often have a hard time saying "No". (Reverse code)
16. I complain about poor service when I am eating out or in other places.
17. When someone says I have done very well, I sometimes just don't know what to say. (Reverse code)
18. If a couple near me in a theatre were talking rather loudly, I would ask them to be quiet or to go somewhere else and talk.
19. I am quick to say what I think.

Scale:

5 = Very much like me
4 = Mostly like me
3 = Somewhat like me
2 = Not much like me
1 = Not like me at all

Technical Competence

Liao, H., Liu, D., & Loi, R. (2010). Looking at both sides of the social exchange coin: A social cognitive perspective on the joint effects of relationship quality and differentiation on creativity. *Academy of Management Journal*, 53(5), 1090-1109.

Items:

Please choose your level of competence in each of the following categories.

1. Electronics experience (e.g., building circuits, repairing electronics, using instruments)
2. Crafting experience (e.g., woodworking, model building, prototyping)
3. Computer ability (e.g., using Word, Excel, PowerPoint)
4. Programming ability (e.g., C/C++, Java, Basic, Fortran, MatLAB, microcontroller)
5. Research experience (e.g., developing surveys, collecting data, identifying research questions)

Scale:

5 = The most competent
4
3 = Moderately competent
2
1 = The least competent

Leader Emergence

Items:

Please answer the following set of questions in regards to those working with you.

1. [Team Member A] takes on leadership responsibilities within the team.
2. [Team Member A] identifies and articulates the team's goals and tasks.
3. The team relies on [Team Member A] for direction.
4. [Team Member A] delegates responsibilities and duties to the other team members.
5. [Team Member A] tracks the progress of team goals.
6. [Team Member A] leads the conversation in the team.
7. [Team Member A] guides and directs our decisions and goals.
8. [Team Member A] influences the group's goals and decisions.

Scale:
5 = Always
4 = Most of the time
3 = Sometimes
2 = Rarely
1 = Never

Leadership effectiveness

Johnson, S. K., Murphy, S. E., Zewdie, S., & Reichard, R. J. (2008). The strong, sensitive type: Effects of gender stereotypes and leadership prototypes on the evaluation of male and female leaders. Organizational Behavior and Human Decision Processes, 106(1), 39-60.

Items:

Please answer the following set of questions in regards to those working with you.

1. [Team Member A] is an effective leader.
2. [Team Member A] succeeds as a team leader.
3. [Team Member A] will improve our team performance.

Scale:

5 = Strongly Agree
4 = Agree
3 = Neutral
2 = Disagree
1 = Strongly Disagree

Leader Likeability

Johnson, S. K., Murphy, S. E., Zewdie, S., & Reichard, R. J. (2008). The strong, sensitive type: Effects of gender stereotypes and leadership prototypes on the evaluation of male and female leaders. Organizational Behavior and Human Decision Processes, 106(1), 39-60.

Items:

Please answer the following set of questions in regards to those working with you.

1. [Team Member A] is liked by the other team members.
2. [Team Member A] is likeable.
3. Our team likes working with [Team Member A].

Scale:

5 = Strongly Agree
4 = Agree
3 = Neutral
2 = Disagree
1 = Strongly Disagree

Personality

Goldberg, L. R. (1999). International Personality Item Pool: A scientific collaboratory for the development of advanced measures of personality and other individual differences. Available at ipip. ori. org/ipip/. Accessed November 15, 2016.

Items:

Please use the rating scale below to describe how accurately each behavioral statement describes you. Describe yourself as you generally are now, not as you wish to be in the future.

Neuroticism

1. Often feel blue.
2. Dislike myself.
3. Am often down in the dumps.
4. Have frequent mood swings.
5. Panic easily.
6. Rarely get irritated. (Reverse code)
7. Seldom feel blue. (Reverse code)
8. Feel comfortable with myself. (Reverse code)
9. Am not easily bothered by things. (Reverse code)
10. Am very pleased with myself. (Reverse code)

Extraversion

1. Feel comfortable around people.
2. Make friends easily.
3. Am skilled in handling social situations.
4. Am the life of the party.
5. Know how to captivate people.
6. Have little to say. (Reverse code)
7. Keep in the background. (Reverse code)
8. Would describe my experiences as somewhat dull. (Reverse code)
9. Don't like to draw attention to myself. (Reverse code)
10. Don't talk a lot. (Reverse code)

Conscientiousness

1. Am always prepared.
2. Pay attention to details.
3. Get chores done right away.
4. Carry out my plans.
5. Make plans and stick to them.
6. Waste my time. (Reverse code)
7. Find it difficult to get down to work. (Reverse code)

8. Do just enough work to get by. (Reverse code)
9. Don't see things through. (Reverse code)
10. Avoid my duties. (Reverse code)

Openness to Experience

1. Believe in the importance of art.
2. Have a vivid imagination.
3. Tend to vote for liberal political candidates.
4. Carry the conversation to a higher level.
5. Enjoy hearing new ideas.
6. Am not interested in abstract ideas. (Reverse code)
7. Do not like art. (Reverse code)
8. Avoid philosophical discussions. (Reverse code)
9. Do not enjoy going to art museums. (Reverse code)
10. Tend to vote for conservative political candidates. (Reverse code)

Agreeableness

1. Have a good word for everyone.
2. Believe that others have good intentions.
3. Respect others.
4. Accept people as they are.
5. Make people feel at ease.
6. Have a sharp tongue. (Reverse code)
7. Cut others to pieces. (Reverse code)
8. Suspect hidden motives in others. (Reverse code)
9. Get back at others. (Reverse code)
10. Insult people. (Reverse code)

Scale:
5 = Very much like me
4 = Mostly like me
3 = Somewhat like me
2 = Not much like me
1 = Not like me at all

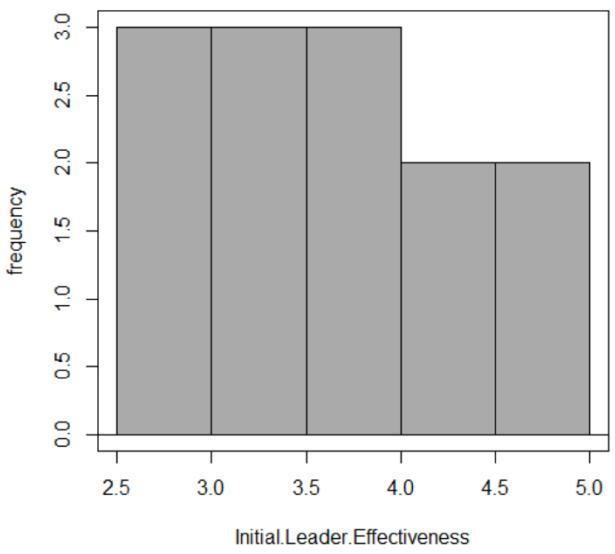
APPENDIX D: Rice University IRB Human Subjects Approval Letter

IRB #: IRB-FY2017-98
Title: Leadership Emergence and Effectiveness
Creation Date: 9-30-2016
End Date: 11-17-2017
Status: Approved
Principal Investigator: Eduardo Salas
Review Board: Institutional Review Board
Sponsor:

Study History

Submission Type Initial	Review Type Expedited	Decision Approved
Submission Type Modification	Review Type Expedited	Decision Approved
Submission Type Modification	Review Type Expedited	Decision Approved

APPENDIX E: Distribution Graphs: Sample 1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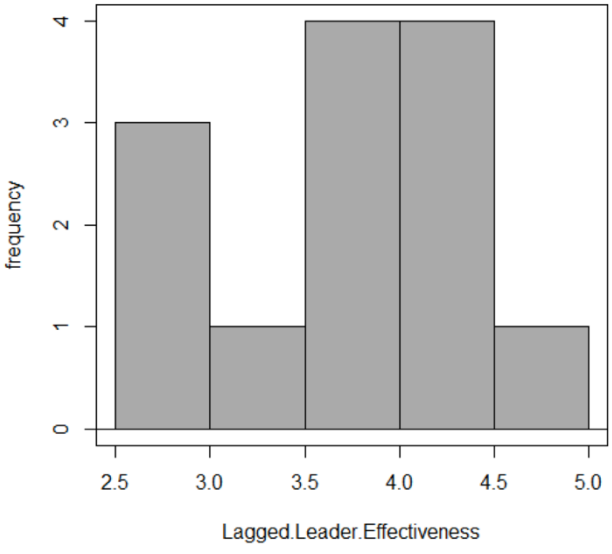
Initial.Leader.Effectiveness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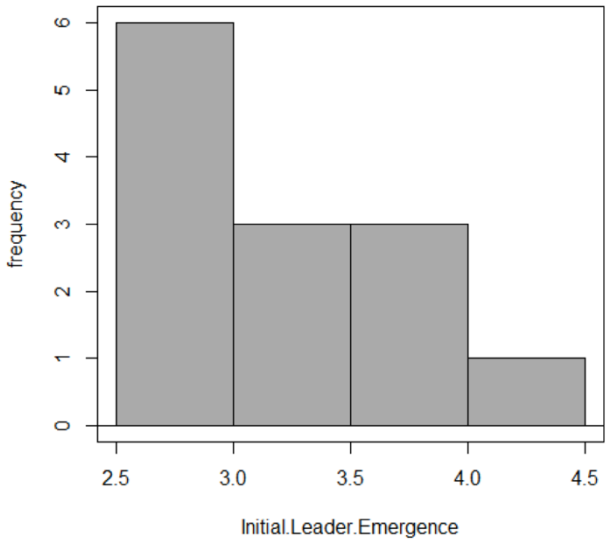
Lagged.Leader.Effectiveness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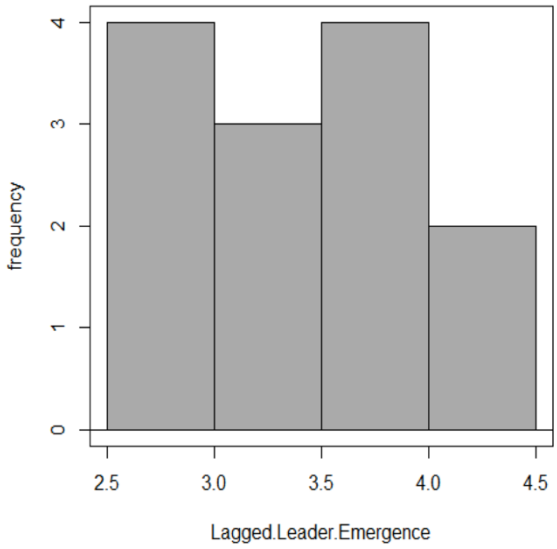
Initial.Leader.Emergence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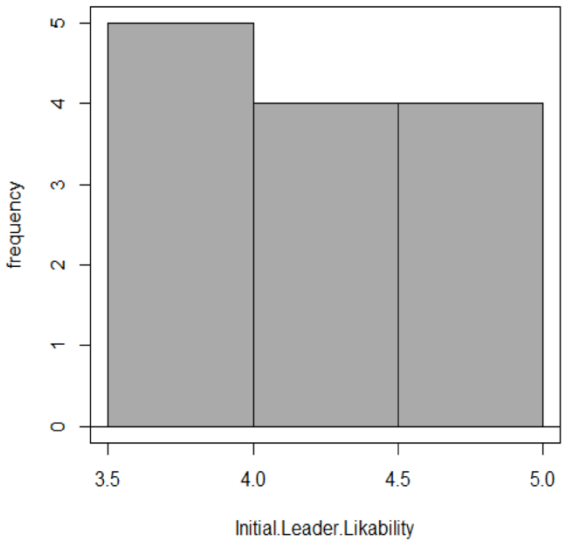
3.0
3.5
4.0
4.5
Lagged.Leader.Emergence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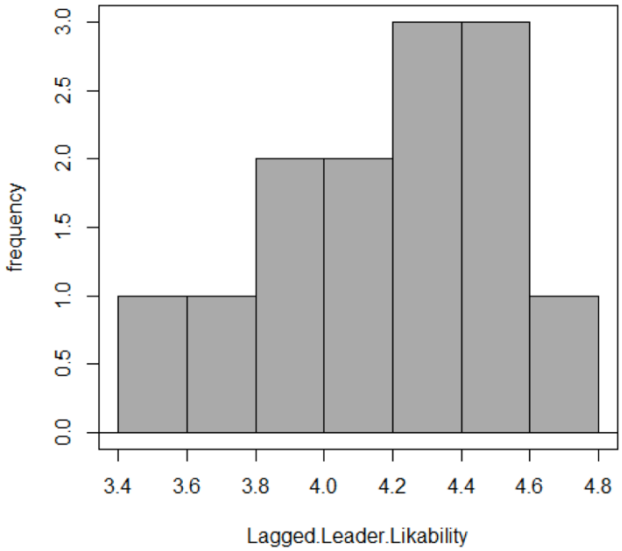
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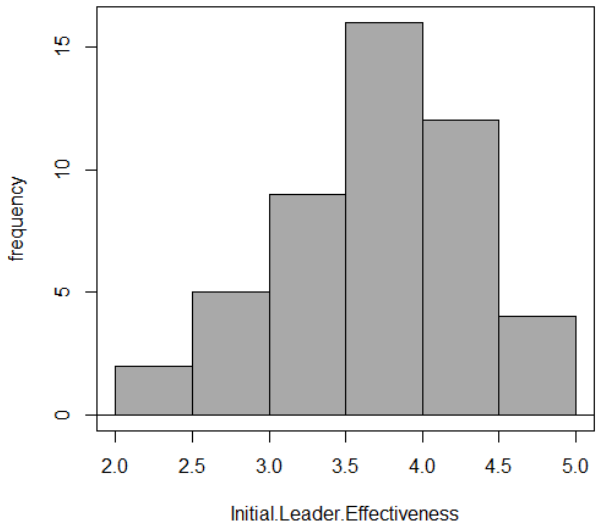
4.8
Lagged.Leader.Likability

APPENDIX F: Distribution Graphs: Sample 2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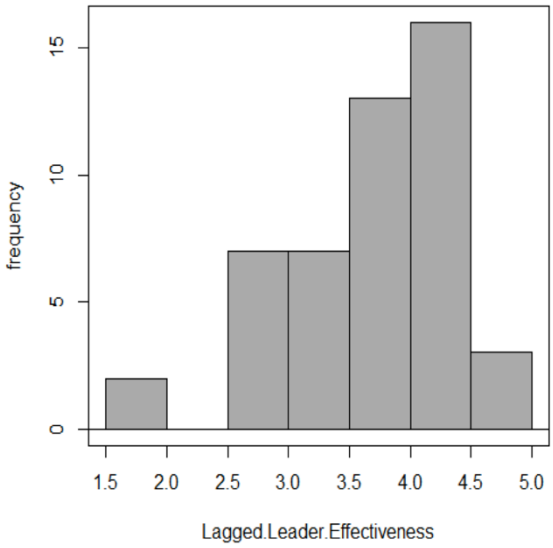
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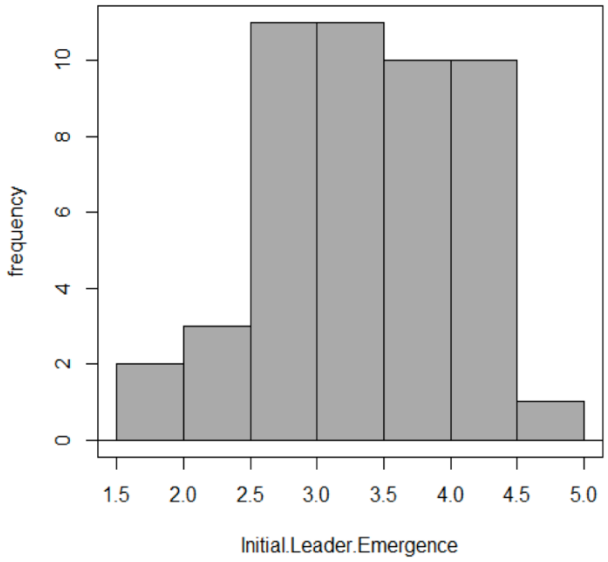
Lagged.Leader.Effectiveness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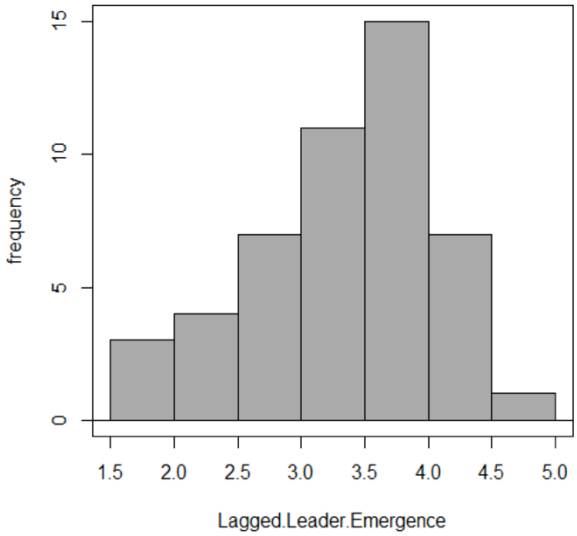
Initial.Leader.Emergence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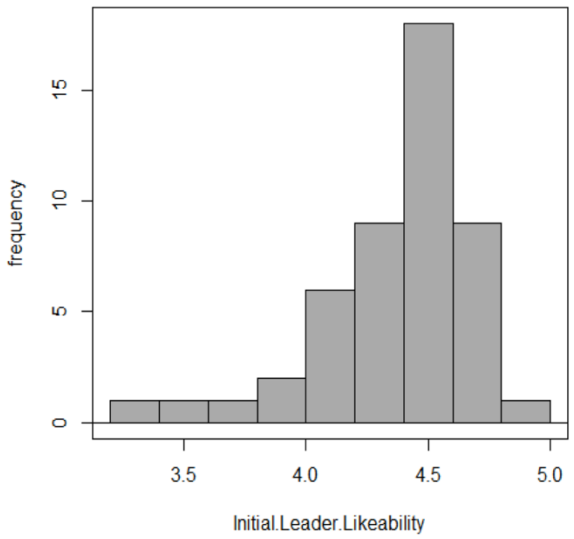
Lagged.Leader.Emergence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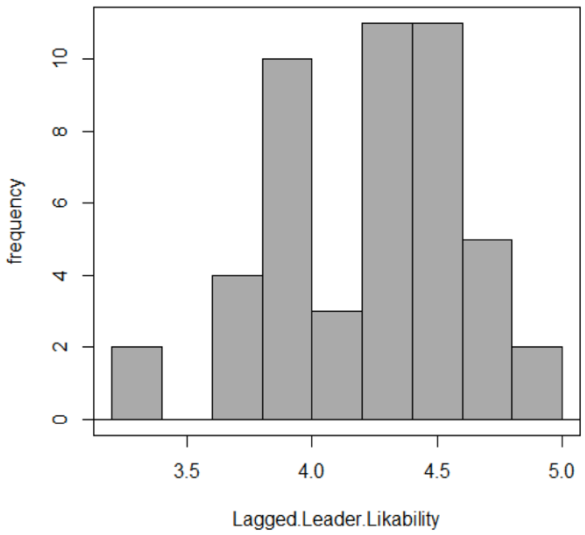
Initial.Leader.Likeability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Lagged.Leader.Likability

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